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ROOFING & WALLING INSTALLATION MANUAL

Contents

1 Introduction

Date of Issue December 2013

This Manual is the 2014 edition of the Lysaght Roofing & Walling Installation Manual, issued December 2013. BlueScope and Lysaght may make changes to this Manual in their sole discretion. You should check you are using the most up-to-date version of the Manual before you start construction. We also have specific publications for all of our products, and you should use them in conjunction with this manual.

Scope

This manual is a guide to the installation of steel roofing and walling manufactured by Lysaght. We intend that it be used by all trades and professions involved with specifying and applying the wide range of our products.

We refer only to genuine steel roofing and walling manufactured by us and marketed under our brand names. Our recommendations should only be used for our products because they are based on comprehensive testing of our profiles, base metal thicknesses (BMT) and material finishes.

Conditions of Use

If you use this Manual, you acknowledge and agree that your use is subject to the terms and conditions in this Manual. Lysaght, its agents, officers, employees, sub-contractors or consultants make no representations, either expressed or implied, as to the suitability of the information and data in this Manual for your particular purposes. It's your responsibility to ensure the design you use is appropriate for your needs, the products you have purchased, your site and structural limitations and your building and construction capabilities.

Use of Genuine Materials

Structures in this Manual should only be built or constructed using genuine LYSAGHT® or recommended third party products. Except as otherwise provided in these terms, any warranties only apply to you (if at all) if you use the recommended genuine LYSAGHT® or third party products and method of construction.

Check Delivery

It is important that you check all materials delivered to site against your invoice before you use them in your building or construction to ensure all components have arrived, are of the appropriate quality and are ready for installation.

Warranties

For over 150 years we have consistently manufactured the highest quality building products. The LYSAGHT® brand is synonymous with Australian building.

Our continuing confidence in our products is shown in the warranties we offer.

Our products are engineered to perform according to our specifications only if they are used in the appropriate conditions and installed to the recommendations in this manual and our other publications.

Naturally, the warranties require specifiers and installers to exercise due care in how the products are applied and installed and are subject to final use and installation. Also, owners need to maintain the finished work.

We invite you to ask about the warranties applicable to your proposed purchase, at your supplier of LYSAGHT products.

GENERAL NOTES TO READ BEFORE YOU USE THIS GUIDE

This Manual has been prepared for a range of roofing and walling applications including water drainage systems, using products manufactured or supplied by Lysaght.

Cyclonic areas

In general, this book refers to non-cyclonic conditions. Design information for cyclonic areas is in our Cyclonic Area Design Manual. The information in this booklet is suitable for use only in areas where a tropical cyclone is unlikely to occur as defined in AS/NZS 1170. 2:2011 Part 2: Structural Actions - Wind Actions (or if used outside Australia, to the equivalent standard).

Information on cyclonic performance may be found in our Cyclonic Area Design manual which is available on-line at www.lysaght.com.

All erection and connection details are to be made in accordance with the relevant standard connection details drawing contained in this Manual.

We recommend you get professional advice to ensure your particular needs are adequately met.

Before you commence construction:

a)) you should check with your local government authority to see if any form of prior permission or approval is required;

b) if you want to build or construct any attached structure, you should seek advice from a suitably qualified engineer to verify the capacity of your existing structure to withstand any additional load arising from the attached structure. You should also check with your local government authority to determine any specific requirements for the attachment to existing structures;

c) you should check with your local workplace health and safety authority to see what safety measures you need to put in place prior to and during construction. It is the responsibility of the installer/erector to ensure all local safe work practices are adhered to and the safety of the whole site is maintained at all times.

To ensure maximum lifespan of your building, consult your nearest Lysaght branch for information regarding maintenance, handling, storage and any other technical assistance you may require.

Lysaght Roofing and Walling Installation Manual

Previously published as:

Lysaght Roofing & Walling Users Guide
Steel Roofing and Walling: Installation Manual, and
Using Lysaght Roofing and Walling

Your suggestions

Please send your suggestions for improvements to this manual to: The Publications Officer, Lysaght Research & Technology, 27 Sterling Road, Minchinbury NSW 2770.

Further information on products and services

- www.roofingwarehouse.com.au
- Your supplier of LYSAGHT products
- Information Service on 07 55 934766

Contemporary and traditional, residential or commercial: all are accomplished with ease using LYSAGHT building products.

PART A: DESIGN
2 Design preliminaries

2.1 Product selection

When you design steel cladding into your building you have a wide range of profiles from which to choose. Whilst roofing and walling obviously have to keep out the weather, they also have significant effects on the looks, cost and durability of a building.

If you are unsure about any product feature, visit www.lysaght.com, call our information line or seek advice from the relevant specialists.

Other factors that affect selection are treated in Chapters 2 to 6.

Walls

The design of walling from a steel perspective is fairly straightforward. Once you have made the aesthetic decision of which profile to use, the main considerations are the support spacings (Section 2.3), fixing details (Chapter 3) and the details of flashing (Chapter 11).

Roofs

There are many factors in designing roofs including:

- the shape: is the roof to be 'flat' or pitched or curved?
- the supporting structure and support spacing;
- the wind forces that the roof must sustain;
- the pitch which affects the looks, the profile's ability to efficiently carry rain to the gutters, and fixing details;
- thermal expansion of long sheets (Chapter 10);
- the attributes of other materials used in the roof design.

This manual doesn't attempt to cover the structural design details of supports or aesthetics: there are many other texts and Australian Standards that cover them.

This chapter gives tables of recommended support spacings, and the maximum roof length for pitch and rainfall intensity for LYSAGHT steel roofing products.

The appropriate design will depend on your particular needs and circumstances. You should get advice from the relevant specialists where required.

2.2 Materials and finishes

Our most widely used cladding profiles are listed in Tables 2.13.1 and 2.14.1. They are available in COLORBOND® prepainted steel, or in unpainted ZINCALUME® magnesium/aluminium/zinc alloy-coated steel.

Material specifications

- Next generation ZINCALUME® aluminium/zinc/magnesium alloy coated steel complies with AS1397:2011 G550, AM125 (550 MPa minimum yield stress, 125 g/m^2 minimum coating mass)
- COLORBOND® is prepainted steel for exterior roofing and walling. It is the most widely used. The painting complies with AS/NZS 2728:2013 and the steel base is an aluminium/zinc alloy-coated steel complying with AS1397:2011. Minimum yield strengths are G550 (550MPa), or G300 (300MPa) depending on profile. Minimum coating mass is AM100 (100g/m^2)
- COLORBOND® METALLIC is prepainted steel for superior aesthetic qualities displaying a metallic sheen.
- COLORBOND® ULTRA is prepainted steel for severe coastal or industrial environments (generally within about 100-200 metres of the source). The painting complies with AS/NZS 2728:2013 and the steel base is an aluminium/zinc alloy-coated steel complying with AS 1397:2011. Minimum yield strength is G550 (550MPa). Minimum coating mass is AM150 (150g/m^2)
- COLORBOND® Stainless is a pre-painted steel for severe coastal or industrial environments. The painting complies with AS/NZS 2728:2013 and the steel base is a stainless steel complying with AISI/ASTM Type 430; UNS No. S43000.

Check with your local Lysaght office for availability of profiles, materials, finishes, colours, accessories; and for suitability of the product.

Tables 2.13.1 and 2.14.1 list general information for profile selection. Refer to our publications on specific products for detailed specifications. There are also publications on ZINCALUME® steel and COLORBOND® prepainted steel from our information line (Page 1).

2.3 Support spacings

The maximum recommended support spacings are shown in Tables 2.13.1 and 2.14.1. They are based on data in accordance with AS 1562.1:1992 Design and installation of sheet roof and wall cladding: Metal, and AS 4040.1:1992 Methods of testing sheet roof and wall cladding—Resistance to concentrated loads.

The spacings in the tables are recommended to produce adequate performance of claddings under concentrated loading (incidental for maintenance).

For support spacings in wind conditions, refer to our publications on specific products for wind pressure data.

In all cases, cladding is fixed to a support of 1.0mm minimum base metal thickness (BMT) and minimum yield stress of G550. If you want to use metal battens thinner than 1.0mm, seek advice from our information line.

2.4 Maximum lengths of roofing

The valleys (or pans) of roofing have to carry water to the gutters. If in heavy rain, the valleys overfill, water can flow into the roof through the side-laps and flashings.

Factors affecting waterproof and drainage capacity of the laps of a profile include:

- the width and depth of the valleys or pans;
- the pitch of the roof—rain flows faster on a steeper pitch;
- rainfall intensity for the geographical area;
- the length of the roof from ridge to gutter; and
- penetrations that cause nearby valleys to carry extra rain diverted from valleys obstructed by the penetration (Figure 2.15.1).

The maximum recommended roof lengths for drainage for each profile are given in Table 2.15.1 at the end of this chapter.

2.5 Low roof pitches

Unless there is adequate positive fall in a roof, there is danger of ponding, which can lead to a reduced service life, particularly in coastal areas.

At low slopes, say around 1 in 50 (1°) slope, all roof supports must be in the one plane because slight variations can result in zero or negative fall. This may occur even after completion of the building as the result of settlement, timber warping or shrinking, or extra loadings (like air conditioners).

Minimum recommended roof slopes are listed in Table 2.13.1. As a guide, wherever possible, you should design for a minimum slope of 1 in 30 (2°). Roof slopes lower than the recommended minimum may be available subject to enquiry and will be dependent upon the roof application and building details. Lower roof slopes may require additional provisions to be adhered to. Please call your nearest service centre for advice.

2.6 Wind forces on roofs

Winds create considerable forces on both the topside and the underside of roof cladding, and you must consider these forces in the design and fixing of any roof. The forces are:

- **inward forces** tending to collapse the roof cladding inwards, caused by wind acting directly on the windward side; and
- **outward forces** tending to lift the roof cladding from its framing, and the entire roof structure from the rest of the building. Outward forces can be caused both by uplift from negative wind pressures, outside the building; and by positive wind pressure inside the building.

Generally the greatest wind forces imposed on roofs are due to the outward forces. Because the dead weight of roofing materials is relatively small, the outward forces must be resisted by the roof fasteners.

It is very important that the battens and roof framing are adequately fixed to the rafters and walls, and that under extreme conditions the wall framing is anchored to the footings. Special anchoring provisions may apply in cyclonic areas. Specialist advice should be sought in these circumstances.

2.7 Codes and performance tests

AS 1562.1:1992 specifies the design and installation of sheet metal roof and wall cladding. Our roofing profiles satisfy all the requirements of this standard, including the ability of the roof to resist outward forces and concentrated loads. The testing is performed according to AS 4040.

Metal roofing products must comply with the performance specifications, and be checked by stringent tests, in accordance with the standard. Such tests have been carried out on all our claddings and the results have been used in the preparation of the fixing and installation recommendations in this manual.

2.8 Environmental conditions

Coated steel products can be damaged by some environmental conditions including industrial, agricultural, marine, intensive animal farming, swimming pools or other aggressive conditions.
If any of our products are to be used in these conditions, or unusually corrosive environments, seek advice from our information line (Page 1).

Keep the product dry and clear of the ground. If stacked or bundled product becomes wet for extended periods, separate it, wipe it with a clean cloth and stack it to dry thoroughly.

2.9 Metal and timber compatibility

Contact with (or run-off from) some materials can damage coated steel products. Buildings can also be susceptible to condensation on inside surfaces.

The materials include certain metals, treated timbers and chemicals.

- Don't allow any contact of coated steel products with incompatible materials. (Table 2.10.1)
- Don't allow discharge of rainwater from incompatible materials onto coated steel products. (Table 2.10.1)
- Ensure that supporting members are compatible with the coated steel products or, alternatively, appropriately coated.

If there are doubts about the compatibility of other products being used, seek advice from our information line.

Incompatible materials include:

- lead
- copper
- monel metal
- bare steel
- stainless steel (except with COLORBOND® stainless cladding)
- carbon (in pencils and some rubbers)
- green or some chemically-treated timber (like CCA or tanalith treatments)
- materials subject to cycles of dryness and wetness or which have excessive moisture content (such as improperly-seasoned timber)
- wet and dry concrete
- soils
- vegetable matter
- cleaning agents (e.g. brick cleaning)
- any material which will inhibit normal exposure to the atmosphere

2.10 Transportation

Because our roofing and walling is manufactured by continuous processes, sheet lengths can be supplied up to the limits of transport regulations, which vary from state to state.

KLIP-LOK 700 HI-STRENGTH® is available in extra long lengths via an on-site mobile rollformer. This service is available nationally, subject to enquiry.

2.11 Paint and COLORBOND® finishes

COLORBOND® finishes can be damaged by some handling, installation or maintenance activities. If damage occurs to the COLORBOND® pre-painted finish, refer to Technical Bulletin TB-2, published by BlueScope.

Replacement of severely damaged COLORBOND® steel should consider that the replacement sheet may not match perfectly due to the possible long term fading of the installed sheets exposed to weathering.

You may overpaint whole roofs and paint accessories to match specific colours. The overpaint guidelines are also discussed in Technical Bulletin TB-2.

Table 2.9.1
Acceptability of drainage from upper surface onto a lower metal surface and direct contact

Compatibility of direct contact between metals or alloys

ROOF DRAINAGE SYSTEM COMPONENTS & ANY CLADDING MATERIAL	ACCESSORIES OR FASTENER OR (UPPER SURFACE)								
	ZINCALUME®	GALVANISED (ZINC COATED STEEL)	ZINC	COLORBOND®, COLORBOND® ULTRA, COLORBOND® METALLIC	COLORBOND® STAINLESS	STAINLESS STEEL	ALUMINIUM ALLOYS	COPPER & COPPER ALLOYS[1]	LEAD
ZINCALUME®	YES	YES	YES	YES	NO	NO	YES	NO	NO
GALVANISED (ZINC COATED STEEL)	YES	YES	YES	YES	NO	NO	YES	NO	NO
ZINC	YES	YES	YES	YES	NO	NO	YES	NO	NO
COLORBOND®, COLORBOND® ULTRA, COLORBOND® METALLIC	YES	YES	YES	YES	NO	NO	YES	NO	NO
COLORBOND® STAINLESS	NO	NO	NO	NO	YES	YES	NO	NO	NO
STAINLESS STEEL	NO	NO	NO	NO	YES	YES	NO	NO	NO
ALUMINIUM ALLOYS	YES	YES	YES	YES	NO[3]	NO[3]	YES	NO	NO
COPPER & COPPER ALLOYS[1]	NO	NO	NO	NO	NO	NO	NO	YES	NO
LEAD	NO	NO	NO	NO	NO	NO	NO	YES	YES

(1) MONEL - COPPER/NICKEL ALLOY
(2) FOR FURTHER GUIDENCE REFER TO AS/NZS 3500.3: 2003
(3) IN BENIGN ENVIRONMENTS, MIXING OF STAINLESS STEEL AND ALUMINIUM MAY BE ACCEPTABLE.

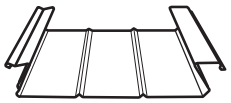
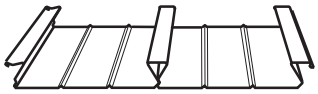
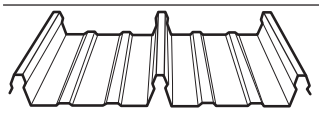
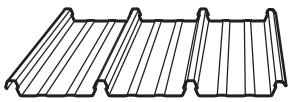
Acceptability of drainage from an upper surface to a lower metal surface

LOWER ROOF DRAINAGE SYSTEM MATERIAL	UPPER CLADDING OR ROOF DRAINAGE SYSTEM MATERIAL									
	ZINCALUME®	GALVANISED (ZINC COATED STEEL)	ZINC	COLORBOND®, COLORBOND® ULTRA, COLORBOND® METALLIC	COLORBOND® STAINLESS	STAINLESS STEEL	ALUMINIUM ALLOYS	COPPER & COPPER ALLOYS[1]	LEAD	GLAZED ROOF TILES, GLASS & PLASTIC
ZINCALUME®	YES	YES	YES	YES	YES	YES	YES	NO	NO	YES
GALVANISED (ZINC COATED STEEL)	NO	YES	YES	NO	NO	NO	NO	NO	YES	NO
ZINC	NO	YES	YES	NO	NO	NO	NO	NO	YES	NO
COLORBOND®, COLORBOND ULTRA®, COLORBOND METALLIC®	YES	YES	YES	YES	YES	YES	YES	NO	NO	YES
COLORBOND® STAINLESS STEEL	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
STAINLESS STEEL	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
ALUMINIUM ALLOYS	YES	YES	YES	YES	YES	YES	YES	NO	NO	YES
COPPER & COPPER ALLOYS[1]	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
LEAD	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

(1) MONEL - COPPER/NICKEL ALLOY
(2) FOR FURTHER GUIDENCE REFER TO AS/NZS 3500.3: 2003

2.12 Specifications - roofing

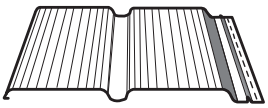
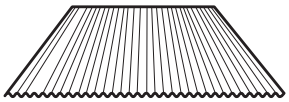
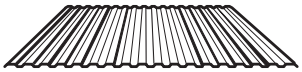
Table 2.12.1
Specifications of roofing & walling profiles

	BMT	Mass[1]	Cover width	Rib depth	Roof pitch minimum[2]	Maximum recommended spacing of supports – ROOFS – Eaves Overhang[3] – Single	End	Internal	Unstiffened	Stiffened	WALLS – Single	End	Internal	Overhang
	mm	kg/m²	mm	mm	degrees	mm	mm	mm	mm	mm	mm	mm	mm	mm
 CUSTOM ORB	0.42	4.3	762	16	5° (1 in 12)	700	900	1200	200	300	1800	2500	2700	200
	0.48	4.9	762	16	5° (1 in 12)	800	1300	1700	250	350	1800	2700	2700	250
 CUSTOM BLUE ORB	0.60	6.1	762	17	5° (1 in 12)	1600	1600	1800	200	300	2400	3000	3300	200
	0.80	8.0	762	17	5° (1 in 12)	1800	1800	2600	400	600	2400	3200	3600	400
 FLATDEK[5]	0.42	6.0	250	45	2° (1 in 30)	2000	2600	3000	-	-	-	-	-	-
 FLATDEK II[5]	0.42	5.2	620	45	2° (1 in 30)	2400	2800	3200	-	-	-	-	-	-
 INTEGRITY 820	0.42	4.6	820	48	2° (1 in 30)	2100	2300	2800	150	300	2600	3400	3600	150
	0.48	5.2	820	48	1° (1 in 50)	2500	2550	3050	200	350	2700	3600	3600	200
 KLIP-LOK 406	0.48	5.6	406	41	1° (1 in 50)	1500	1800	2100	200	600	-	-	-	-
 KLIP-LOK 700 HI-STRENGTH	0.42	4.7	700	43	2° (1 in 30)	1650	1750	2200	150	450	2600	3200	3850	150
	0.48	5.3	700	43	1° (1 in 50)	2050	2350	2800	200	500	3000	3450	3900	200
	0.60	6.6	700	43	1° (1 in 50)	2350	3000	3600	250	550	3300	3600	3900	250
 KLIP-LOK CLASSIC 700	0.42	4.7	700	41	2° (1 in 30)	-	1800	2200	200	500	-	2150	3250	300
	0.48	5.3	700	41	1° (1 in 50)	-	2100	3050	250	600	-	2500	3550	400
 LONGLINE 305 (not tapered)	0.70	9.7	305	48	1° (1 in 50)	1800	2000	2500	150	450	-	2700	2700	450
 SPANDEK	0.42	4.7	700	24	3° (1 in 20)[7]	1300	1800	2400	300	600	2500	3000	3300	300
	0.48	5.3	700	24	3° (1 in 20)[7]	2000	2200	3000	400	700	3000	3000	3300	400
 SPANRIB	0.42	4.6	820	48	2° (1 in 30)	2100	2300	2800	150	300	2600	3400	3600	150
	0.48	5.2	820	48	1° (1 in 50)	2500	2550	3050	200	350	2700	3600	3600	200
 TRIMDEK	0.42	4.3	762	29	2° (1 in 30)	1100	1300	1900	150	300	2400	3000	3000	150
	0.48	4.9	762	29	2° (1 in 30)	1600	1850	2600	200	350	2700	3000	3000	200

[1] Masses are for unpainted ZINCALUME steel.
[2] See Section 2.5.
[3] See Section 10.6 for explanation of 'stiffened'.
[5] FLATDEK & FLATDEK II are Home Improvement profiles. Please refer to the brochures for more installation details..
[7] Slope of 2° (1 in 30) is available subject to enquiry. Please refer to Section 2.5.

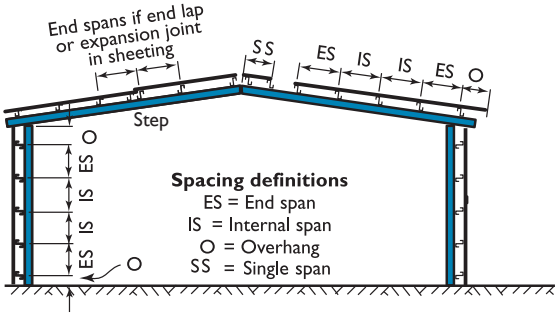
2.13 Specifications - walling

Table 2.13.1
Specifications of profiles for walling only

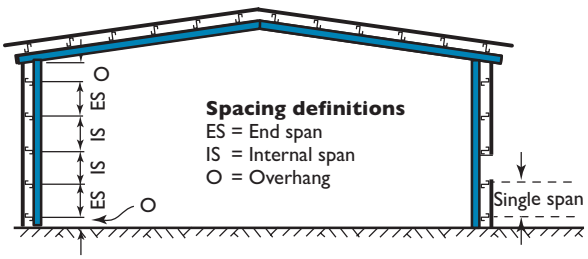
	BMT	Mass[1]	Cover width	Rib depth	Maximum recommended spacing of wall supports			
					Single	End	Internal	Overhang
	mm	kg/m²	mm	mm	mm	mm	mm	mm
 EASY-CLAD	0.42	4.5	300	19	–	1500	1500	100
 MINI ORB	0.42 0.48	4.0 4.5	820 820	6 6	1200 1500	1500 1500	1500 1500	100 125
 MULTICLAD	0.35 0.42	3.3 3.9	840 840	12 12	1400 1700	1800 1800	1800 1800	150 150
 PANELRIB	0.35 0.42	3.2 3.7	850 850	4 4	1100 1200	1200 1200	1200 1200	150 150
 TRIMWALL	0.35	3.6	762	29	2100	2900	3000	150
 WALLCLAD	0.35	3.6	762	16	1800	2400	2400	150
 WEATHERBOARD	0.42	4.1	260	12	-	1000	1000	n/a

[1] Masses are for unpainted ZINCALUME steel.

Roofing & Walling profiles



Walling profiles only

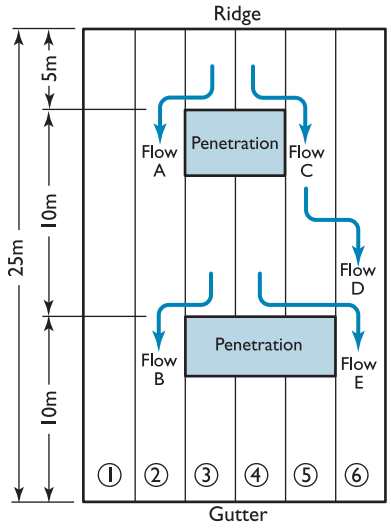


2.14 Maximum roof lengths for drainage

Table 2.14.1
Maximum roof lengths for drainage measured from ridge to gutter (m) Penetrations alter the flow of water on a roof. Thus, for design, you need to use an effective roof length (Figure 2.14.1).

	Peak rainfall intensity mm/hr	Roof slope						Peak rainfall intensity mm/hr
		1 in 50 (1°)	1 in 30 (2°)	1 in 20 (3°)	1 in 12 (5°)	1 in 7.5 (7.5°)	1 in 6 (10°)	
CUSTOM ORB CUSTOM BLUE ORB	100				29	34	38	100
	150				20	23	25	150
	200				15	17	19	200
	250				12	14	15	250
	300				10	11	13	300
	400				7	8	10	400
	500				6	7	8	500
INTEGRITY 820 SPANRIB	100		410	480	598	713	820	100
	150		273	320	399	476	547	150
	200		205	240	299	357	410	200
	250		164	192	239	285	328	250
	300		137	160	199	238	273	300
	400		102	120	150	178	205	400
	500		82	96	120	143	164	500
KLIP-LOK 406	100	375	467	548	682	813	934	100
	150	250	311	365	454	542	623	150
	200	188	234	274	341	406	467	200
	250	150	187	219	273	325	374	250
	300	125	156	183	227	271	311	300
	400	94	117	137	170	203	234	400
	500	75	93	110	136	163	187	500
KLIP-LOK 700 HI-STRENGTH	100	344	428	502	624	745	856	100
	150	229	285	334	416	496	571	150
	200	172	214	251	312	372	428	200
	250	137	171	201	250	298	342	250
	300	115	143	167	208	248	285	300
	400	86	107	125	156	186	214	400
	500	69	86	100	125	149	171	500
KLIP-LOK CLASSIC 700	100	**247**	**308**	**361**	**449**	**536**	**616**	100
	150	**165**	**205**	**241**	**300**	**357**	**411**	150
	200	**124**	**154**	**181**	**225**	**268**	**308**	200
	250	**99**	**123**	**144**	**180**	**214**	**246**	250
	300	**82**	**103**	**120**	**150**	**179**	**205**	300
	400	**74**	**93**	**108**	**135**	**161**	**185**	400
	500	**49**	**62**	**72**	**90**	**107**	**123**	500
LONGLINE 305 (not tapered)	100	219	273	320	398	475	546	100
	150	146	182	213	265	317	364	150
	200	110	136	160	199	237	273	200
	250	88	109	128	159	190	218	250
	300	73	91	107	133	158	182	300
	400	55	68	80	100	119	136	400
	500	44	55	64	80	95	109	500
SPANDEK	100		97	111	133	154	173	100
	150		65	74	89	103	115	150
	200		49	55	67	77	86	200
	250		39	44	53	62	69	250
	300		32	37	44	51	58	300
	400		24	28	33	39	43	400
	500		19	22	27	31	35	500
TRIMDEK	100		220	257	320	382	439	100
	150		146	172	214	255	293	150
	200		110	129	160	191	220	200
	250		88	103	128	153	176	250
	300		73	86	107	127	146	300
	400		55	64	80	96	110	400
	500		44	51	64	76	88	500

- Some lengths in this table may exceed the maximum allowable transport length.
- Data are based on work of CSIRO and BlueScope Lysaght.
- For peak rainfall intensities in your locality, see Chapter 6.
- LYSAGHT FLATDEK and FLATDEK II are recommended for home improvement use only (carports/verandahs) where weathertightness is not of primary importance. Drainage figures are therefore not supplied.
- SPANDEK with slope of 2° (1 in 30) is available subject to enquiry. Please refer to Section 2.5.



Valley	Effective length
1	25m (Base length)
2	Base length + A + B = 25 + 5 + 10 = 40m
6	Base length + C + D + E = 25 + 5 + 15 + 10 = 55m (Worst case used for design)

Figure 2.14.1
Example of calculating effective roof lengths where penetrations alter the flow of water on a roof.

NOTE: A suitably qualified engineer is recommended for calculating/checking roof design and flow design.

3 Fasteners

When you select fasteners, you should consider the design life of the structure, because the fasteners and the cladding material should have similar life expectancies.

Fastener change to metric sizing

The Australian fastener industry is moving to a change in fastener description that will bring it into line with international markets. This is an on-going process as product requirements and design changes.

Traditionally self drilling fasteners have been described in gauge (outside thread diameter), by tpi (threads per inch) and by length (mm). The new changes will convert gauge to metric sizing (eg #12 is approx. M5.5)

3.1 Materials for screws

Screws are available in a variety of materials, finishes and colours to match COLORBOND® prepainted steel, and design. You should use screws to AS 3566:2002 Class 3 (or better). Additional information on fastener finishes is in the technical bulletin TB-16.

Table 3.1.1

Materials for screws

Product	Appropriate screw materials
For most external applications not closer than 400 metres from the ocean or severe marine influence: • COLORBOND®or METALLIC • ZINCALUME®AZ150	AS 3566 Class 3
For severe exposure conditions: • COLORBOND®(200 to 400 metres from marine environments) • COLORBOND®ULTRA (100 to 200 metres from marine environments)	AS 3566 Class 4 Where the colour match of fasteners is an overriding consideration, powder coated/painted fasteners may be used.
For very severe exposure conditions: COLORBOND®STAINLESS	Stainless steel

Stainless steel fasteners are recommended for use only with COLORBOND STAINLESS.

3.2 Materials for nails

Nails should be of galvanised steel. They are only used to fix the clips of some concealed-fixed cladding to timber supports.

3.3 Materials for blind rivets

For COLORBOND® STAINLESS use stainless steel blind rivets with stainless steel mandrels; for GALVABOND®, ZINCALUME® and COLORBOND® steels, use aluminium blind rivets. Blind rivets are used for fixing flashings, accessories and side-laps.

3.4 Materials for sealing washers

Sealing washers used under the heads of screws on COLORBOND® finishes must be made from materials that don't have significant levels of conductive carbon black, particularly in marine environments. Use EPDM washers, not neoprene.

3.5 Identification of screws

The format of the number code is:

12 – 14 x 50

M6 – 11 x 50

Screw gauge (Thread outside diameter) M refers to metric size	Thread pitch (threads per inch)	Overall length of the screw measured from under the head to the tip of the drill point (mm)

Fasteners must have a coating system to meet AS 3566 Class 3 or AS 3566 Class 4.

Ripple Teks®, AutoTeks®, Teks®, Designer Heads® and Zips® are registered trademarks of ITW Buildex and are recommended for

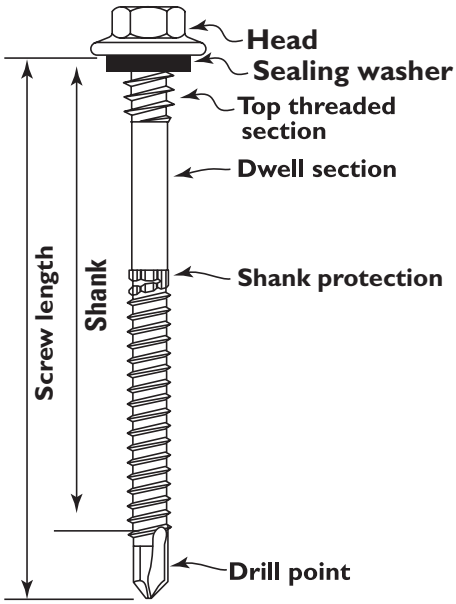


Figure 3.5.1
Typical roofing screws

specific applications. Vortex® is a registered trademark of Bremick and is recommended for specific applications. Other equivalent quality fasteners which comply to the above standards are also recommended for use with LYSAGHT roofing and walling products.

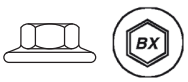
Where a screw penetrates roof sheeting (for fixing or stitching), a sealing washer is recommended. The sealing washer is to be an EPDM non-conductive rubber.

Where a screw penetrates the rib of the sheeting (as for roofing), the 'top thread section' feature is recommended to maximise resistance to water penetration.

3.6 Setting of screws

Fasteners with sealing washers should be tightened only until the washer is gripped firmly enough to provide a weathertight seal. The fasteners should not be over-tightened because this may split the sealing washer or deform the sheet, either of which could lead to water penetration. Take particular care when valley fixing because there is no flexibility with the sheet hard against its support. Take particular care to ensure the fastener is driven perpendicular to the sheeting to avoid deformation of the washer.

Table 3.5.1
Typical features of screws

Head	Shank	Drill point
Hexagon head with integrated metal washer  **Hex. head with EPDM seal**	Top Thread Section Extrudes sheeting towards the seal to maximise resistance to water penetration. Grips the sheeting for a secure connection. Stops sheeting from moving when walked on.	Self drilling for metal  **RoofZip® point**
Hexagon head with integrated metal washer  **Hex. head with no seal**	Dwell Section Prevents the sheeting from riding up during fixing and minimises distortion of the profile.	Self drilling for timber  **Drill point** Type 17
Wafer head  **Wafer head with no seal**	Shank Protection Enlarges the hole in the sheeting to minimise damage to the protective coating on the screw.	Self drilling for metal  **Drill point** Standard metal
		Self drilling for metal  **Extended drill point**
Special self-sealing head  **RippleZips® screw head with self-sealing head.**		Self drilling for metal  **RippleZip® point**

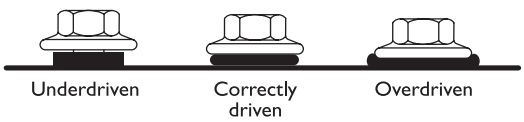


Figure 3.6.1
It is important that you set screws correctly

3.7 Quantity of fasteners and clips

KLIP-LOK 406, KLIP-LOK 700HS, KLIP-LOK CLASSIC 700 and LONGLINE 305

For number of clips, see equation at right.

For KLIP-LOK 406, there are 2 fasteners per clip.

For KLIP-LOK 700 HI-STRENGTH and KLIP-LOK CLASSIC 700 there are 3 fasteners per clip.

For LONGLINE 305, there is 1 fastener per clip.

Pierce-fixed profiles

For number of fasteners, see equation at right (n is the number of fasteners per support, as shown in the diagrams for each cladding product.

Side-laps

Side-lap fasteners are often placed at about 900mm centres. (See section 8.5)

3.8 Recommended fasteners and locations

The recommended fasteners and minimum specifications for a cladding are detailed in the individual cladding brochure. The location of the fasteners are detailed in the following diagrams for each cladding product.

Fastener length with insulation, boards and packers

Where insulation (blankets or boards, foam packers or any other packer/board where the cladding screw penetrates through the support) is installed under cladding, you may need to increase the length of screws, depending on the density and thickness of the insulation, board or packer. When the screw is properly tightened (Section 3.6):

- INTO METAL: The screw manufacturer's recommendations for screw penetration should be complied with. Generally there should be at least one full thread protruding past the support you are fixing. If there are three (3) threads visible (even partial threads) then the penetration requirements are met. Where rib fixing is done, then the 'shank protection' must not reach the support (Figure 3.8.1);
- INTO TIMBER: the screw must penetrate the timber by the same amount that the recommended screw would do if there were no insulation, i.e. same embedment.
- For deep insulation, board or packer the availability of a suitable screw, with all the recommended features and minimum specifications will need to be investigated. It may be necessary to increase the screw gauge accordingly or seek advice from the screw manufacturer. Site trial of screw fixing may need to be conducted to determine the suitability of the selected screw.

Fixing to steel thicker than 3mm

Use appropriate self-drilling screws with an extended drill point; or pre-drill hole and seek advice from the screw manufacturer on the appropriate screw specifications.

Number of clips per job =
(Number of supports) x (Number of sheets +1)
for LONGLINE 305 and KLIP-LOK 406, or
(Number of supports) x (Number of sheets)
for KLIP-LOK 700HS and KLIP-LOK CLASSIC 700

Number of fasteners per job =
LONGLINE 305 = number of clips
KLIP-LOK 406 = number of clips x 2
KLIP-LOK 700HS = number of clips x 3
KLIP-LOK CLASSIC 700 = number of clips x 3

Number of fasteners per job (for pierced fixing) =
n x (Number of sheets) x (Number of supports)

Side-lap and accessory fastenings

For MINI ORB and PANELRIB

- Use 3.2mm diameter aluminium sealed blind rivets.

For all other products use:

- RoofZips® M6 -11 x 25 or
- M5-16 x 25 Designer Head® or
- Hex Head Metal Teks® with seal: 10-16 x 16; or
- Sealed blind rivets: 4.8mm diameter aluminium

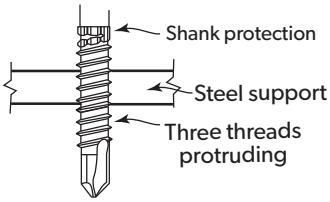


Figure 3.8.1
Setting screws correctly

Table 3.8
Guide to estimate fasteners and clips required for typical installation

Fastener & Clip Requirement Guide (per m²)

Cladding profile	No. of fasteners (or clips) per sheet width	Sheet Cover Width	Maximum support spacings (mm)					
			450[1]	600[1]	900	1200	1500	1800
CUSTOM ORB®	3	762	9	7	5	4	3	3
	5	762	15	11	8	6	5	4
CUSTOM BLUE ORB®	3	762	9	7	5	4	3	3
	5	762	15	11	8	6	5	4
EASYCLAD®	1	300	8	6	4	3	3	2
INTEGRITY 820®	3	820	—	—	—	3	2	2
KLIP-LOK 406®	2	406	—	—	6	5	4	3
	1 CLIP	406	—	—	3	2	2	1
KLIP-LOK 700 HI-STRENGTH®	3	700	—	—	5	4	3	3
	1 CLIP	700	—	—	2	1	1	1
KLIP-LOK CLASSIC® 700	3	700	—	—	5	4	3	3
	1 CLIP	700	—	—	2	1	1	1
LONGLINE 305® (not tapered)	1	305	—	—	4	3	2	2
	1 CLIP	305	—	—	4	3	2	2
MINI ORB®	6	820	17	13	9	7	5	5
	11	820	30	22	15	11	9	7
MULTICLAD®	4	840	11	8	6	4	4	3
PANELRIB®	4	850	11	8	6	4	4	3
	8	850	21	16	10	8	6	5
SPANDEK®	3	700	10	8	5	4	3	3
	4	700	13	10	6	5	4	3
SPANRIB®	3	820	—	—	—	3	2	2
TRIMDEK®	4	762	12	9	6	5	4	3
TRIMWALL®	4	762	12	9	6	5	4	3
WALLCLAD®	3	762	9	7	5	4	3	3
	5	762	15	11	8	6	5	4

[1] Typical residential framing spacings.

Table 3.8.1
Guide to fastener fixing and layout

CUSTOM ORB, CUSTOM BLUE ORB (AND WALLCLAD)

Sheet coverage

Width of roof (m)	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	30	40	50
Number of sheets	4	6	7	8	10	11	12	14	15	16	18	19	20	21	23	24	25	27	40	53	66

Crest: 3 fasteners†

Pan/Valley: 3 fasteners†

Crest: 5 fasteners†

Pan/Valley: 5 fasteners†

Width covered by 'x' number of sheets (m)

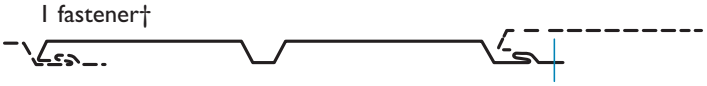
Number of sheets	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Coverage (m)	2.3	3.0	3.8	4.6	5.3	6.1	6.9	7.6	8.4	9.1	9.9	10.7	11.4	12.2	13.0	13.7	14.5	15.2

EASYCLAD

Sheet coverage

Height of wall (m)	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	30	40	50
Number of sheets	10	14	17	20	24	27	30	34	37	40	44	47	50	54	57	60	64	67	100	134	167

1 fastener†



Width covered by 'x' number of sheets (m)

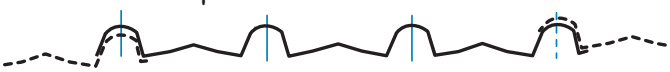
Number of sheets	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Coverage (m)	0.9	1.2	1.5	1.8	2.1	2.4	2.7	3.0	3.3	3.6	3.9	4.2	4.5	4.8	5.1	5.4	5.7	6.0

INTEGRITY 820

Sheet coverage

Width of roof (m)	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	30	40	50
Number of sheets	4	5	7	8	9	10	11	13	14	15	16	18	19	20	21	22	24	25	37	49	61

Crest: 3 fasteners†



Width covered by 'x' number of sheets (m)

Number of sheets	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Coverage (m)	2.5	3.3	4.1	4.9	5.7	6.6	7.4	8.2	9.0	9.8	10.7	11.5	12.3	13.1	13.9	14.8	15.6	16.4

KLIP-LOK 700HS & KLIP-LOK CLASSIC 700

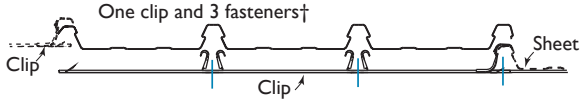
Sheet coverage

Width of roof (m)	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	30	40	50
Number of sheets	5	6	8	9	10	12	13	15	16	18	19	20	22	23	25	26	28	29	43	58	72

KLIP-LOK 700 HI-STRENGTH

One clip and 3 fasteners†

KLIP-LOK CLASSIC 700



Width covered by 'x' number of sheets (m)

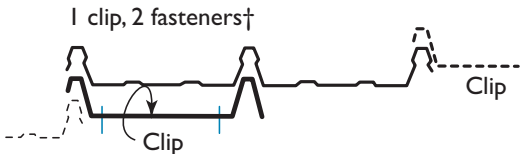
Number of sheets	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Coverage (m)	2.1	2.8	3.5	4.2	4.9	5.6	6.3	7.0	7.7	8.4	9.1	9.8	10.5	11.2	11.9	12.6	13.3	14.0

KEY
† Fasteners per sheet per support

KLIP-LOK 406

Sheet coverage

Width of roof (m)	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	30	40	50
Number of sheets	8	10	13	15	18	20	23	25	28	30	33	35	37	40	42	45	47	50	74	99	124



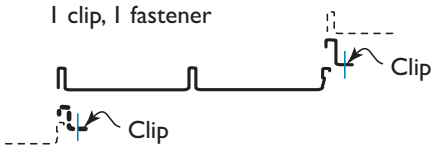
Width covered by 'x' number of sheets (m)

Number of sheets	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Coverage (m)	1.2	1.6	2.0	2.4	2.8	3.2	3.7	4.1	4.5	4.9	5.3	5.7	6.1	6.5	6.9	7.3	7.7	8.1

LONGLINE 305 (NOT TAPERED)

Sheet coverage

Width of roof (m)	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	30	40	50
Number of sheets	10	14	17	20	23	27	30	33	37	40	43	46	50	53	56	60	63	66	99	132	164



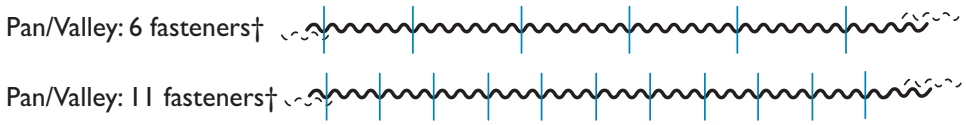
Width covered by 'x' number of sheets (m)

Number of sheets	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Coverage (m)	0.9	1.2	1.5	1.8	2.1	2.4	2.7	3.1	3.4	3.7	4.0	4.3	4.6	4.9	5.2	5.5	5.8	6.1

MINI ORB

Sheet coverage

Width of wall (m)	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	30	40	50
Number of sheets	4	5	7	8	9	10	11	13	14	15	16	18	19	20	21	22	24	25	37	49	61



Width covered by 'x' number of sheets (m)

Number of sheets	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Coverage (m)	2.5	3.3	4.1	4.9	5.7	6.6	7.4	8.2	9.0	9.8	10.7	11.5	12.3	13.1	13.9	14.8	15.6	16.4

MULTICLAD

Sheet coverage

Width of wall (m)	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	30	40	50
Number of sheets	4	5	6	8	9	10	11	12	14	15	16	17	18	20	21	22	23	24	36	48	60

Width covered by 'x' number of sheets (m)

Number of sheets	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Coverage (m)	2.5	3.4	4.2	5.0	5.9	6.7	7.6	8.4	9.2	10.1	10.9	11.8	12.6	13.4	14.3	15.1	16.0	16.8

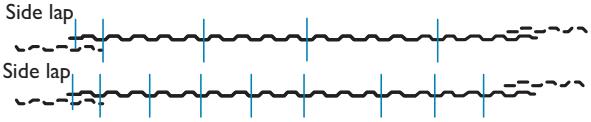
KEY
† Fasteners per sheet per support

PANELRIB

Sheet coverage

Width of wall (m)	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	30	40	50
Number of sheets	4	5	6	8	9	10	11	12	13	15	16	17	18	19	20	22	23	24	36	48	59

Pan: 4 fasteners† Side lap



Pan: 8 fasteners† Side lap

Width covered by 'x' number of sheets (m)

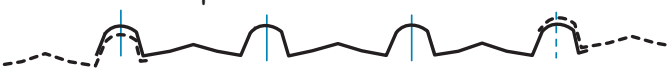
Number of sheets	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Coverage (m)	2.6	3.4	4.3	5.1	6.0	6.8	7.7	8.5	9.4	10.2	11.1	11.9	12.8	13.6	14.5	15.3	16.2	17.0

SPANRIB

Sheet coverage

Width of roof (m)	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	30	40	50
Number of sheets	4	5	7	8	9	10	11	13	14	15	16	18	19	20	21	22	24	25	37	49	61

Crest: 3 fasteners†



Width covered by 'x' number of sheets (m)

Number of sheets	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Coverage (m)	2.5	3.3	4.1	4.9	5.7	6.6	7.4	8.2	9.0	9.8	10.7	11.5	12.3	13.1	13.9	14.8	15.6	16.4

SPANDEK

Sheet coverage

Width of roof (m)	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	30	40	50
Number of sheets	5	6	8	9	10	12	13	15	16	18	19	20	22	23	25	26	28	29	43	58	72

Crest: 3 fasteners†

Side lap

Pan/Valley: 3 fasteners†

Crest: 4 fasteners†

Pan/Valley: 4 fasteners† Side lap

Width covered by 'x' number of sheets (m)

Number of sheets	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Coverage (m)	2.1	2.8	3.5	4.2	4.9	5.6	6.3	7.0	7.7	8.4	9.1	9.8	10.5	11.2	11.9	12.6	13.3	14.0

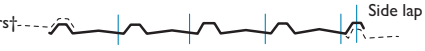
TRIMDEK & TRIMWALL - (TRIMWALL pan fasten only)

Sheet coverage

Width of roof (m)	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	30	40	50
Number of sheets	4	6	7	8	10	11	12	14	15	16	18	19	20	21	23	24	25	27	40	53	66

Crest: 4 fasteners†

Pan/Valley: 4 fasteners† Side lap



Width covered by 'x' number of sheets (m)

Number of sheets	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Coverage (m)	2.3	3.0	3.8	4.6	5.3	6.1	6.9	7.6	8.4	9.1	9.9	10.7	11.4	12.2	13.0	13.7	14.5	15.2

WALLCLAD - (Valley/pan fasten only)

Valley fixed	All fixing as specified for CUSTOM ORB

Pan/Valley: 3 fasteners† Side-lap

Pan/Valley: 5 fasteners† Side-lap

Width covered by 'x' number of sheets (m)

Number of sheets	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Coverage (m)	2.3	3.0	3.8	4.6	5.3	6.1	6.9	7.6	8.4	9.1	9.9	10.7	11.4	12.2	13.0	13.7	14.5	15.2

KEY
† Fasteners per sheet per support

4 Curved, bent & tapered cladding

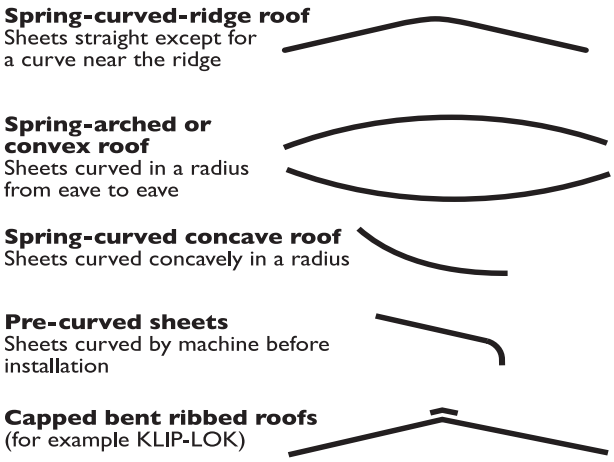


Figure 4.1
Typical curved and bent applications

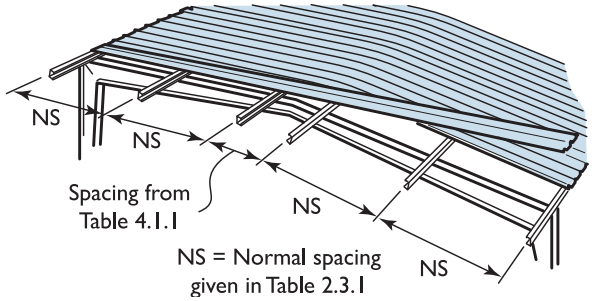


Figure 4.1.1
Spring-curved-ridge roof

Curved sheets can be used for both roofing and walling applications. Sheeting can be curved into either concave or convex shapes as required.

An excellent method of cladding low-slope gable roofs is to run continuous lengths of roofing from eave to eave, across the full width of the roof. This gives a particularly neat and attractive roof. It is also possible to spring-curve sheets into a concave shape.

With the exception of KLIP-LOK, the ridge capping is eliminated in these roofs, thus avoiding any possibility of leakage along the ridge. KLIP-LOK can be used similarly, but the ribs are cut at the ridge and a metal cap is fitted over the cut.

4.1 Spring-curved-ridge roof

Sheets in a spring-curved-ridge roof remain straight except for a curve near the ridge.

The pans of KLIP-LOK, INTEGRITY, LONGLINE 305 and TRIMDEK tend to oilcan (minor waviness in the pan) when spring curved.

Apart from not looking good, an oilcanned pan may retain water which could lead to discolouration and/or deterioration of the sheet coating and also contributes to thermally induced roof noise. If some oilcanning in the pans is acceptable, these profiles can be spring-curved up to a maximum slope of 1 in 30 (2°); with the spacing between the purlins at the ridge being slightly less than the internal span recommended for the profile in Table 2.12.1.

Over the supports at the ridge, very slight crease marks may appear in the pans or valleys when subjected to foot traffic. They don't affect strength and will usually not be seen from the ground.

Only the sheet profiles recommended for spring-curving are shown in Table 4.1.1.

Each sheet is first fixed to one side of the roof, and then pulled down to be fixed to the other side. To minimise small laying errors, lay alternate sheets from opposite sides of the roof.

Side laps should be sealed with silicone sealant for the length of the curve.

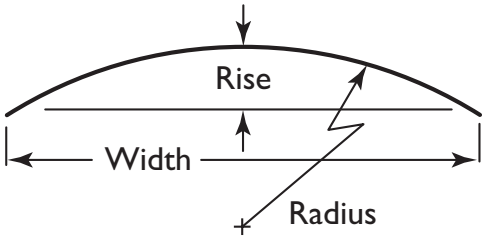
Table 4.1.1
Minimum spacing of purlins at ridge for spring-curved-ridge roof (mm)

	1 in 20 (3°)	1 in 15 (4°)	1 in 12 (5°)	1 in 10 (6°)	1 in 8 (7°)
SPANDEK 0.42 BMT	1400	1500			
SPANDEK 0.48 BMT	1500	1600	1700		
CUSTOM ORB 0.42 BMT			1200		
CUSTOM ORB 0.48 BMT			1300	1400	
CUSTOM BLUE ORB 0.60 BMT			1200	1300	1400

Blank spaces are combinations not recommended

4.2 Spring-arched roof

Sheets in a spring-arched (convex) roof are curved in a radius from eave to eave. SPANDEK, LONGLINE 305, CUSTOM ORB and CUSTOM BLUE ORB can be spring-curved for an arched roof. Table 4.2.1 shows the acceptable radii.
The top face of all purlins must accurately follow and be tangential to the radius of the arch. The radius of curvature can be calculated from the formula in Figure 4.2.1.



$$\text{Radius} = \frac{\text{Width}^2 + 4(\text{Rise})^2}{8 \times \text{Rise}}$$

Figure 4.2.1
Calculation of radius

Table 4.2.1
Recommended radii for convex spring-curving

	Minimum radius (m)	Purlin spacing at minimum radius (m)	Maximum radius[1] (m)
SPANDEK 0.42 BMT	20	1200	60
SPANDEK 0.48 BMT	20	1400	60
CUSTOM ORB 0.42 BMT	12	800	35
CUSTOM ORB 0.48 BMT	10	1000	35
CUSTOM BLUE ORB 0.60 BMT	9	900	35
LONGLINE 305 0.7 BMT	26	1600	180
LONGLINE 300 0.7 BMT (Fluted)	26	1600	180
LONGLINE 0.7 BMT (Tapered)	26	1600	180

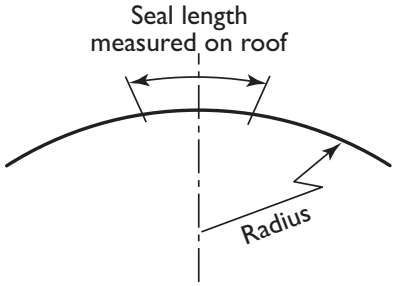
[1] Maximum radius is to provide sufficient drainage near crest of arch.

At the crest of an arch the roof is flat, which is obviously below the specified minimum roof pitch. Therefore side laps of shallow roof profile as such as CUSTOM ORB, CUSTOM BLUE ORB and SPANDEK should be sealed over the crest of the arch until there is sufficient pitch to give adequate drainage (see Table 2.3.1). The length of seal is shown in Figure 4.2.2. Refer to Section 8.5 for side-lap fixing and Section 7.9 for sealant application.

Over the supports very slight crease marks may appear in the pans or valleys when subjected to foot traffic. They don't affect strength and will usually not be seen from the ground.

If end laps are necessary they should not be located at or near the crest of the arch and each sheet length must span at least three purlin spacings.

Profiles with wide pans manufactured from high tensile steel (such as KLIP-LOK, SPANRIB and INTEGRITY 820) are susceptible to local buckling of the pans and are therefore not recommended for spring-arched roofs. These products may be made specially from soft steel (G300) to minimise the problem.



Seal length =
0.035 x Radius x specified minimum roof pitch

CUSTOM ORB and CUSTOM BLUE ORB
(min. roof pitch 5): Seal length = 0.18 x radius

SPANDEK
(min. roof pitch 3): Seal length = 0.11 x radius

Figure 4.2.2
Seal length for side laps on spring-arched roof

Each sheet is first fixed to one side of the roof, and then pulled down to be fixed to the other side. Alternate sheets are laid from opposite sides of the roof.

4.3 Spring-curved concave roofs

Roofing can be spring-curved into concave shapes. Table 4.3.1 shows the acceptable radii.

Table 4.3.1
Radii for spring curved concave roofs

	Minimum radius (m)	Purlin spacing (m)
KLIP-LOK 406 0.48 BMT	26	1400
SPANDEK 0.42 BMT	18	1200
SPANDEK 0.48 BMT	20	1400
TRIMDEK 0.42 BMT	20	1000
TRIMDEK 0.48 BMT	22	1200
CUSTOM ORB 0.42 BMT	10	800
CUSTOM ORB 0.48 BMT	10	1000
CUSTOM BLUE ORB 0.60 BMT	8	800
LONGLINE 305 0.70 BMT	26	1600

The purlin spacing may be increased for radii greater than the minimum radii shown, provided the spacing does not exceed that shown in Table 2.3.1

For fluted and tapered LONGLINE please contact your local Service Centre for advice.

Roof pitch at the lower end of the sheeting must not be less than the minimum shown in Table 2.3.1

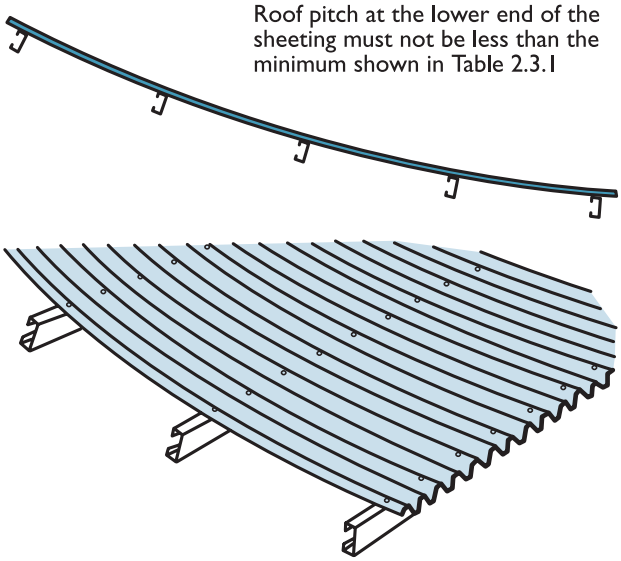


Figure 4.3.1
Spring-curved concave roof

4.4 Pre-curved sheets

Pre-curving of CUSTOM BLUE ORB and MINI ORB is available for various applications - we don't recommend pre-curving for other profiles.
Pre-curved corrugated roofing is popular for aesthetics (such as a bullnosed verandah roof), or for function (such as a gutterless eave design). CUSTOM BLUE ORB can be curved to a small radius (300 to 400mm - local variations apply).

MINI ORB can be curved to a radius to as small as 150mm, though it isn't recommended for roofing.

Because of the spacing of curving rolls, there is usually a straight portion at the end of the sheet beyond the curve (often 50 to 110mm for CUSTOM BLUE ORB, and about 50mm for MINI ORB). Allow for this in your design. It can be trimmed off if necessary.

If a pre-curved section of cladding is to be joined to a straight section, it is recommended that you order the curved and straight sheets at the same time, asking for them to be matched in production to ensure a quality end-lap. End-lap the sheets as described in Section 10.4 (End-lapping).

Our CUSTOM BLUE ORB and the MINI ORB pages of the LYSAGHT Walling Products brochure gives more details on curving.

4.5 Capped bent ribbed roofs

Tray cladding can be used in continuous lengths from eave to eave by cutting the ribs and bending the pans at the ridgeline. The same process is used on Mansard roofs. Caps are fitted over the cut ribs, which open up when the pans are bent. Fitting the rib caps can be time-consuming and care must be taken with sealing to avoid any possibility of leakage.

The ribs must be cut squarely, with a metal cutting blade in a power saw, set to the depth of the rib minus 2mm.

In some states pressed steel caps may be available to suit KLIP-LOK ribs, though the range of angles is limited. Caps can be handmade to suit any angle from flat sheet.

KLIP-LOK is most frequently used for capped bent ribbed roofs, but LONGLINE 305, TRIMDEK or even SPANDEK can be used. For these four profiles the rib caps can be made from pieces of rib profile cut from a short length of cladding. A neutral-cure silicon sealant should be used.

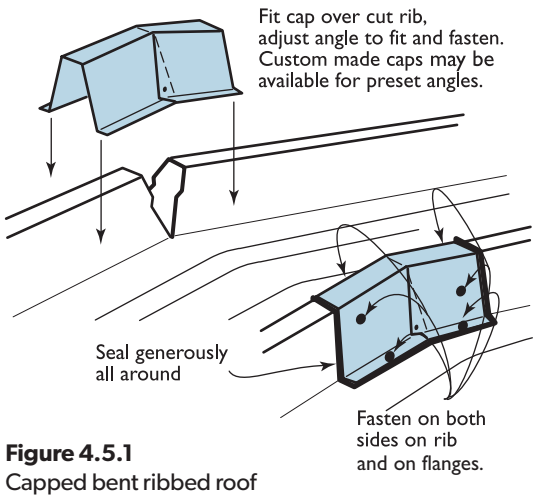


Figure 4.5.1
Capped bent ribbed roof

4.6 Tapered roofing.

LONGLINE products

The LONGLINE cladding product is available in cover widths of:

- LONGLINE 305 - Wide flat pans, with a uniform cover width of 305mm.
- Fluted LONGLINE – Flat panned profile with subtle "concertina" type with longitudinal pan stiffeners with a uniform cover width of 300mm.
- Tapered LONGLINE - "Concertina" type stiffeners running longitudinally in the pans varying from a subtle definition to a bold definition. Cover width varying from a wide end of 305mm, down to a narrow end of as low as 145mm.

With combinations of fluted and tapered sheets, and/or with spring curving, striking or special architectural effects can be achieved.

The tapered LONGLINE results in a fan effect on roofs. Alternating the arrangement of tapered sheets or the combination of tapers/fluted or standard LONGLINE 305 sheets will result in various patterns and textures being achieved.

All tapers are linear tapers. The tapers are manufactured in the standard mode (termed on the production line as FORWARD taper) or in the non-standard mode (termed on the production line as REVERSE taper).

The normal manufacture is "FORWARD" and unless specified the FORWARD taper will be produced.

The orientation of installation of the sheets will govern as to which end of the roof that laying can commence. On some projects the choice of laying direction is important and thus the selection of the correct direction of taper (Forward or Reverse) is vital.

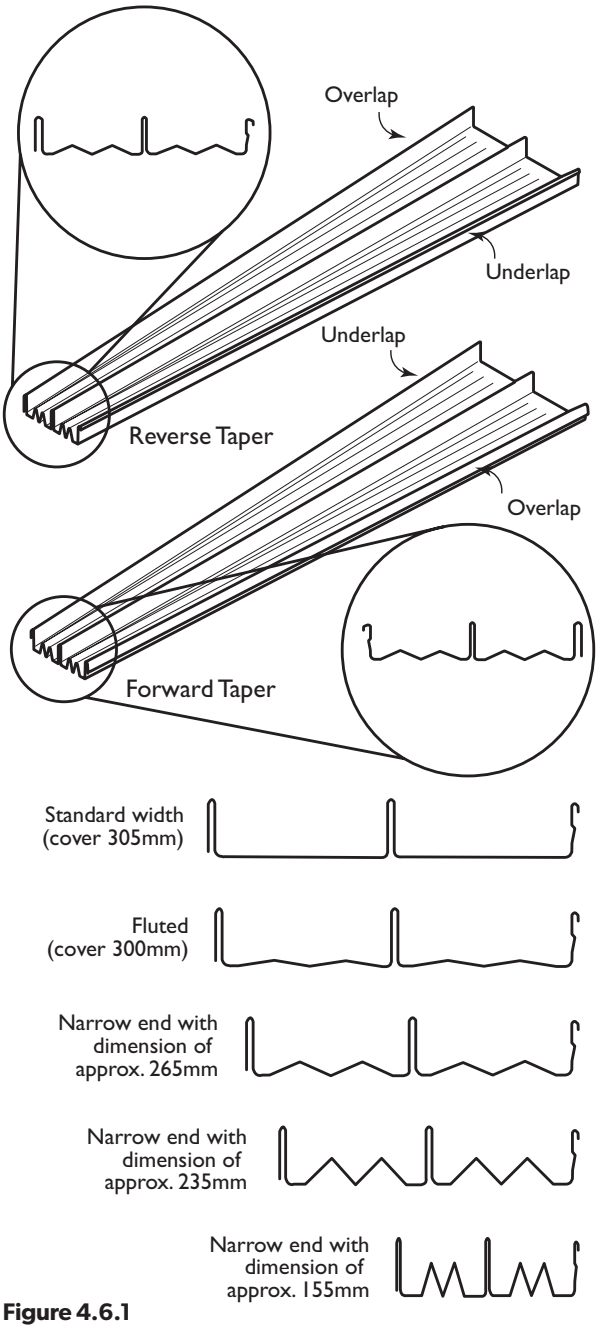


Figure 4.6.1
Tapered LONGLINE 305

5 Insulation & skylights

You often consider insulating a building to reduce:

- heating from the sun in summer;
- loss of heat from inside in winter;
- condensation on the inside of the roofing and walling; and
- noise from rain, thermal expansion and contraction, and other sources.

Usually, when one of these four is treated, there is also a beneficial effect on the others.

You need to compare the initial cost of installing insulation with the savings in costs of heating and cooling. There are also gains for the environment when you save energy.

HB63-1994 Home Insulation in Australia - Recommended insulation level for all States thoroughly treats the subject, including comprehensive tables of recommended thermal resistance (R values) for over 1000 towns throughout Australia.

5.1 Heat control

In summer buildings get hot from the sun and we want to cool the inside; in winter we often heat the inside and want to avoid losing that heat.
Factors in controlling heat include:

- the orientation of the building relative to the sun;
- external shading from trees or other buildings;
- design of the building, especially ventilation and sealing at doors and windows;
- the colours and surface gloss of the cladding.

The first three factors are outside the scope of this book. Heat is absorbed into a sheet on one side, and some of that absorbed heat is re-radiated from the other side (Figure 5.1.1).

- Light-coloured or shiny surfaces don't absorb much heat, and they radiate little.
- Dark-coloured or dull surfaces absorb a lot of heat, and they radiate a lot. This doesn't stop you using darker claddings because you can use reflective foil laminate under the cladding.

COLORBOND® steel with THERMATECH® technology

THERMATECH® solar reflectance technology is now included in the standard COLORBOND® steel palette. COLORBOND® steel with THERMATECH® technology reflects more of the sun's heat, allowing both roofs and buildings stay cooler in summer. In moderate to hot climates, compared to roofing materials of similar colour with low solar reflectance, COLORBOND® steel with THERMATECH® can reduce annual cooling and energy consumption by up to 20%.

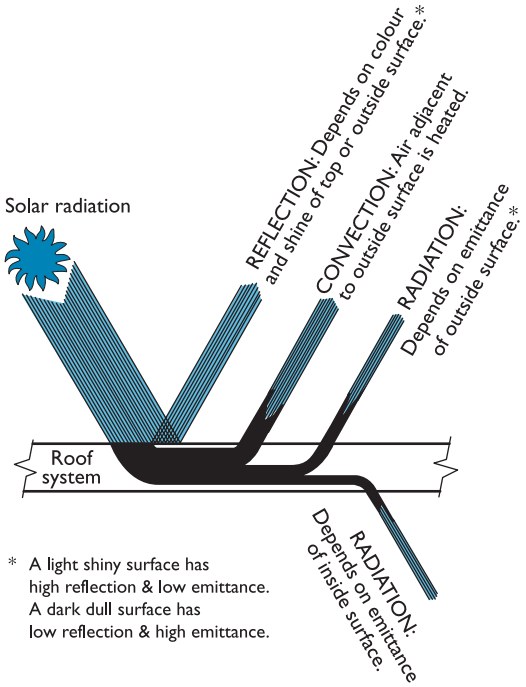


Figure 5.1.1
Heat transmitted into a building

Comparison of thermal performance

Table 5.1.1 shows thermal performances of different insulation systems by showing the heat that may be expected through roofs of new materials.

Heat control methods

In roofs, a simple, inexpensive and very effective method is to drape a membrane of reflective foil laminate over the supports before laying the cladding. The laminate can also provide a vapour barrier to minimise condensation. If the membrane is allowed to drape 50 to 75mm between the supports the air space between the membrane and the roof cladding will further improve heat insulation (Figure 5.1.2).

Additional heat insulation is often achieved by using bulk insulation blankets or batts (Figure 5.1.3).

The same principles apply to walls, though the foil is not draped.

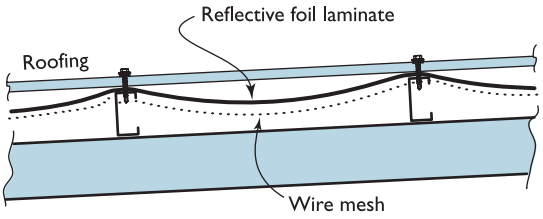


Figure 5.1.2
Reflective foil laminate is simple, cheap and very effective

5.2 Condensation

When the air in a building in contact with metal cladding is warmer than the cladding, water vapour (moisture) in the air can condense on the inside of the cladding.

Water vapour passes fairly freely through most building linings into the ceiling and wall spaces where it may directly contact the cladding.

Condensation can lead to deterioration of building components and staining of ceiling and walls. If insulation blankets or batts are wet, or even slightly dampened by condensation, its efficiency is reduced markedly.

The amount of condensation depends upon the amount of water vapour in the air and this varies with climatic conditions. Activities within a building can add substantially to the amount of water vapour, and typical domestic situations include bathing, showering, cooking, washing and drying clothes and dishes, and breathing. It is essential to vent substantial amounts of water vapour to outside the building.

To minimise the risk of condensation on the underside of roofing, a vapour barrier is often used to prevent contact of warm moist air with the roofing – reflective foil laminate is commonly used.

To minimise the risk of condensation on the underside of the laminate, the laminate must be draped between roof supports so that the cold cladding is not in contact with the laminate (except at the supports).

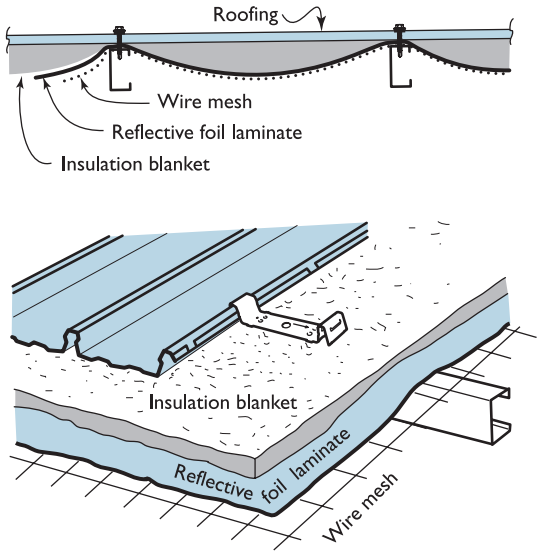


Figure 5.1.3
Typical roof insulation with foil and blanket

Table 5.1.1
Approximate thermal transmission (for comparisons only)

	Roofing only		Roofing with reflective foil laminate		Roofing with 50 mm insulation blanket & reflective foil laminate	
	Heat radiated from underside W/m²	Heat radiated + convected W/m²	Heat radiated from underside W/m²	Heat radiated + convected W/m²	Heat radiated from underside W/m²	Heat radiated + convected W/m²
ZINCALUME®	25	40	2.0	9.0	2.0	7.0
COLORBOND®						
Coolmax® (Whitehaven®)22.5		26.6	0.9	3.8	0.6	2.7
Classic Cream®, Surfmist®37.1		43.8	1.5	6.1	1.1	4.3
Sandbank®	59.7	70.3	2.4	9.6	1.7	6.9
Wilderness®	91.2	106.9	3.6	14.4	2.5	10.3
Woodland Grey®	101.4	118.7	4.0	15.9	2.8	11.3
Deep Ocean®	108.2	126.6	4.3	16.9	3.0	12.0

Assumptions
- solar radiation = 850 W/m² (' average' Australian summer)
- ambient temperature = 30° C
- wind velocity over roof = 3 m/s
- still air under the roof system
- inside temperature = 30° C

5.3 Noise reduction

Rain noise

To reduce rain noise on metal roofing, an insulation blanket can be placed over the foil laminate described above, before laying the roofing. It is important that the laminate is pulled tight enough to hold the blanket hard against the underside of the roofing so as to dampen the rain-induced vibration at the point of impact. If the blanket is not hard against the roofing the noise reduction will not be as good.

For purlin spacings over 1200mm: first lay wire mesh over the purlins, tighten and fix it, before laying the membrane.

Thermally-induced noise

Roofing expands and contracts due to temperature changes in the cladding, and particularly rapid changes can be caused by passing clouds or a strong breeze. For example: if a passing cloud suddenly shades the roof from the sun, the cladding temperature could drop about 3°C after 30 seconds in shade and about 10°C after 2 minutes in shade.

Thermally-induced noise is caused by slipping at fasteners where the roof expands relative to its supports. The slipping is controlled by the friction between the roof and its supports. When the static friction is overcome impulsively, sounds are produced — sometimes as loud as a pistol-shot — the higher the friction, the louder the sound. No damage to the cladding or fasteners will occur.

The noise can be reduced by:

- placing a material with low coefficient of friction between the roofing and its supports (for example PVC tape or strips of foil laminate);
- choosing steel supports rather than timber (lower coefficient of friction);
- choosing light coloured roofing;
- venting the roof space;
- including an expansion joint (Section 10.5); being careful about design details in valleys (where heat tends to be retained); and/or
- insulating the roof space to reduce the thermal differential. In tropical areas it may be better to insulate the ceiling rather than the roofing (which can also reduce noise) by having the silver foil facing upwards towards the roofing, instead of downwards towards the ceiling.;
- insulation previously recommended to overcome rain noise will also reduce the thermally induced clicking noise.

5.4 Insulation materials

Typical insulation materials are reflective foil laminates, insulation blankets or batts made from fibreglass, and boards made from polystyrene. Remember that the colour of cladding also has a marked effect (Section 5.1).

Foil laminates

Foil laminates reflect heat and can double-up as a vapour barrier to control condensation. Where they are used as a vapour barrier the joints between successive strips are overlapped about 100mm, and sealed with a tape impervious to moisture.

Blankets and batts

Blankets and batts minimise heat convection and are available with the laminate bonded to the fibreglass. They are also effective in reducing noise.

Insulation blankets must be protected from moisture, particularly around the edges of the roof and even more particularly at the bottom end of the cladding where rainwater run-off can be blown back under a low-pitched roof. If the blanket overhangs the bottom support, it may even come into contact with water in the gutter, where the insulation will absorb moisture and remain damp for extended periods, thus leading to deterioration of the coating on the underside of the roofing and reducing the effectiveness of the insulation.

Insulation blankets up to a nominal thickness of up to 100mm for pierce-fixed cladding and KLIP-LOK 700HS; and up to 50mm for KLIP-LOK 406 and all other concealed-fixed profiles will compress sufficiently over the roof supports to allow normal procedures to be used for fixing.

For KLIP-LOK CLASSIC 700, in thicknesses between 75-100mm, seek advice from our technical support line. However, you may need to increase the length of fasteners slightly to allow for the thickness of the compressed blanket between the cladding and support.

Polystyrene boards

Expanded and extruded polystyrene is also used for the same purposes as blankets and batts. The boards are more rigid and relatively less compressible which demand different fixing to that mentioned above. Seek advice from manufacturers of polystyrene insulation.

5.5 Insulation thickness (glass wool)

Insulation blankets and batts can cause cladding to bow out between the fasteners. To minimise this problem, the maximum thickness of blankets and batts should be 100mm for pierce-fixed cladding and KLIP-LOK 700HS and 50mm for KLIP-LOK 406 and all LONGLINE 305. (Maximum density 12kg/m^3.) For KLIP-LOK CLASSIC 700, in thicknesses between 75-100mm, seek advice from our technical support line. For more dense glass wool and rock wool, and thicker insulation, spacers are recommended.

5.6 Skylighting

One of the simplest methods of getting natural light through a steel roof is the inclusion of translucent sheets which match the steel profiles.

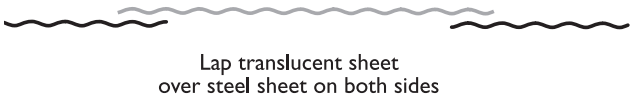
It is preferable to use profiled translucent cladding in single widths so that they can overlap, and be supported by, the steel cladding on both sides. It is also preferable to position the lengths of translucent cladding at the top of a roof run so the high end can lap under the capping or flashing and the low end can overlap a steel sheet. This is because the translucent cladding will readily overlap a steel sheet but the reverse is difficult.

Building regulations require a safety mesh to be fitted under translucent cladding.

Because of its greater thermal expansion, translucent cladding should be fixed using oversized holes and sealing washers recommended by the translucent cladding manufacturer. When used with concealed fixed claddings, ensure the fasteners do not penetrate the steel cladding. There are translucent products available that easily accommodate this and some translucent products have a clip-fixing system to allow thermal movement. Don't exceed the maximum support spacing specified by the translucent cladding manufacturer.

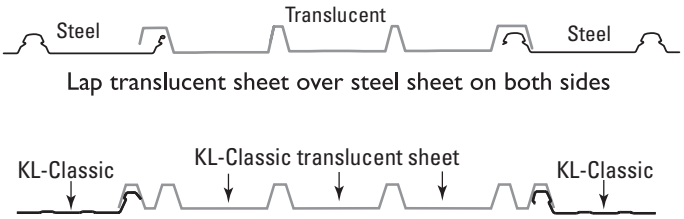
Skylighting increases the transmission of solar heat. Generally speaking, heat transmission is proportional to light transmission, so the more sunlight that enters a building the hotter it will be. Clear, uncoloured fibreglass has good light transmission of about 65% but this means on a typical summer day, with peak solar radiation of 850 W/m^2, transmission through a clear fibreglass skylight would be about 550 W/m^2.

Translucent fibreglass cladding is available to match CUSTOM ORB, INTEGRITY 820, KLIP-LOK 406, KLIP-LOK CLASSIC 700, KLIP-LOK 700HS, LONGLINE 305, SPANDEK and TRIMDEK. Polycarbonate cladding is also available for CUSTOM ORB and TRIMDEK.



Lap translucent sheet
over steel sheet on both sides

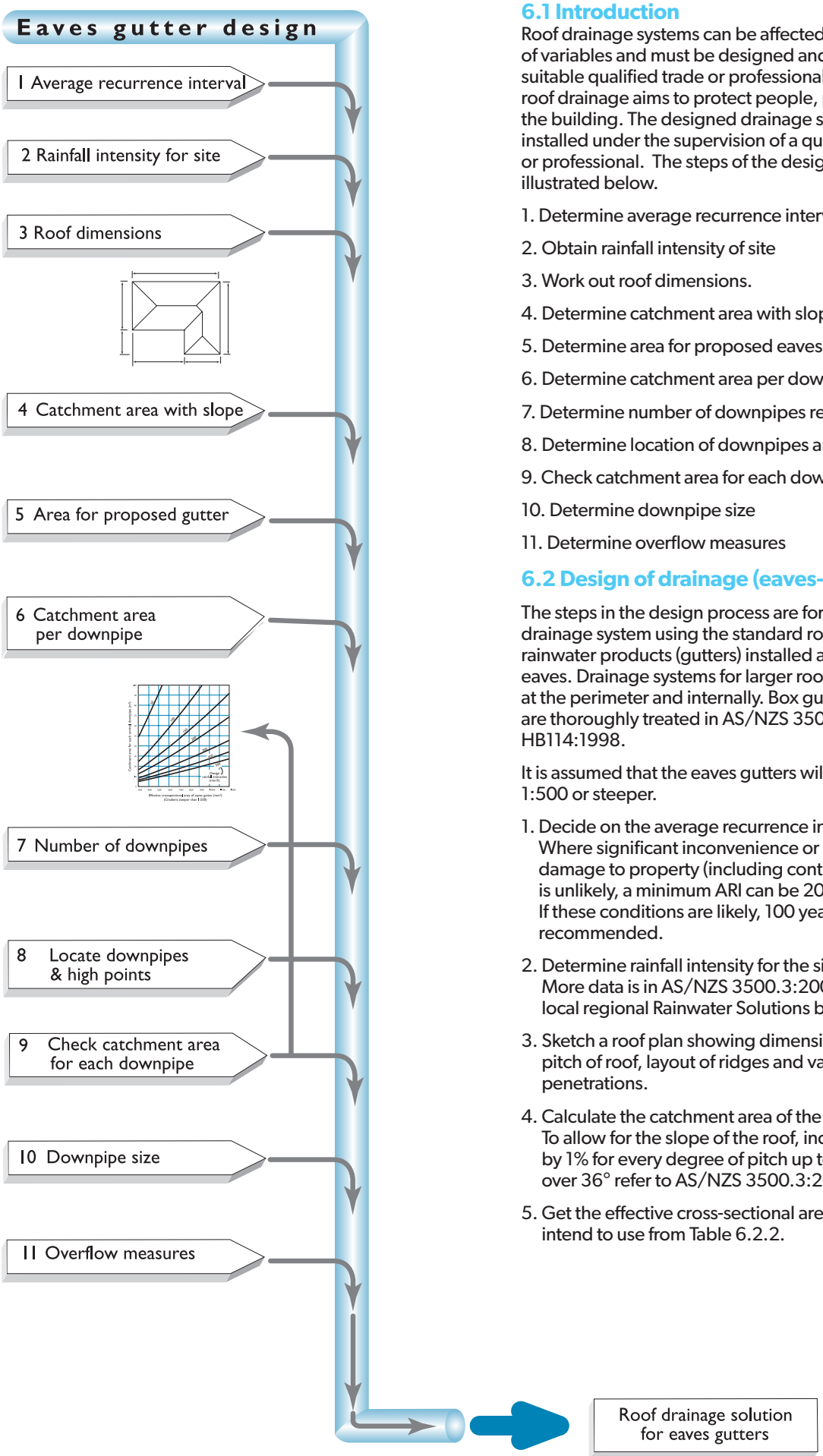
Figure 5.6.1
Placement of translucent sheets - pierce fixed decks



Lap translucent sheet over steel sheet on both sides

Figure 5.6.2
Placement of translucent sheets - concealed fixed decks

6 Roof drainage



6.1 Introduction

Roof drainage systems can be affected by a number of variables and must be designed and detailed by a suitable qualified trade or professional. The design of roof drainage aims to protect people, property and the building. The designed drainage system must be installed under the supervision of a qualified trade or professional. The steps of the design process are illustrated below.

1. Determine average recurrence interval (ARI)
2. Obtain rainfall intensity of site
3. Work out roof dimensions.
4. Determine catchment area with slope
5. Determine area for proposed eaves gutter.
6. Determine catchment area per downpipe
7. Determine number of downpipes required
8. Determine location of downpipes and high points
9. Check catchment area for each downpipe.
10. Determine downpipe size
11. Determine overflow measures

6.2 Design of drainage (eaves-gutter system)

The steps in the design process are for a perimeter drainage system using the standard roll-formed rainwater products (gutters) installed at the building eaves. Drainage systems for larger roofs use box gutters at the perimeter and internally. Box gutter systems are thoroughly treated in AS/NZS 3500.3:2003 and HB114:1998.

It is assumed that the eaves gutters will have a gradient of 1:500 or steeper.

1. Decide on the average recurrence interval (ARI). Where significant inconvenience or injury to people, or damage to property (including contents of a building), is unlikely, a minimum ARI can be 20 years. If these conditions are likely, 100 years is recommended.
2. Determine rainfall intensity for the site from Table 6.2.1. More data is in AS/NZS 3500.3:2003; B.C.A. or in our local regional Rainwater Solutions brochure.
3. Sketch a roof plan showing dimensions in plan view, pitch of roof, layout of ridges and valleys and large roof penetrations.
4. Calculate the catchment area of the roof from the plan. To allow for the slope of the roof, increase the plan area by 1% for every degree of pitch up to 36°. For pitches over 36° refer to AS/NZS 3500.3:2003.
5. Get the effective cross-sectional area of the gutter you intend to use from Table 6.2.2.

6. Using the cross-sectional area of the gutter on the graph in Figure 6.2.2, determine the catchment area per downpipe.

7. Calculate (as a first test) the minimum number of downpipes required for the selected gutter using the equation:

$$\left.\begin{array}{c}\text{Number of}\\ \text{downpipes (min.)}\end{array}\right\} = \frac{\text{Total catchment area of the roof}}{\text{Catchment area (determined in 6)}}$$

Round the number of downpipes up to the next whole number.

8. On the plan, select locations for the downpipes and the high points in the gutters. Where practical, the catchments for each downpipe should be about equal in area.

   When selecting the location of high points and downpipes, consideration should also be given to proximity to high concentrations of water flow (e.g. valley gutters, diversions around large roof penetrations, dormers, etc.) More guidance is given in AS/NZS 3500.3:2003, HB114:1998 and BCA.

   Calculate the area of each catchment for each downpipe.

9. With the area of your eaves gutter, check that the catchment area for each downpipe, calculated in Step 8, is equal to or less than the catchment area shown by the graph.

   If a catchment area is too big then you can:

   - Increase the number and size of downpipes;
   - Reposition the downpipes and/or the high points;
   - Choose a gutter with bigger effective cross-sectional area, & repeat the above from Step 6.

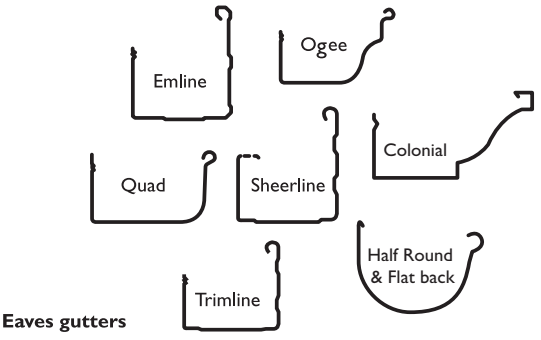
10. Decide on the downpipe size. Recommendations in AS/NZS 3500.3:2003 on downpipe sizes. As an approximate guide, the area of round pipes should be equal to the area of the gutter, whilst the area of square or rectangular pipes may be 20% smaller (Table 6.2.2).

11. Consider measures to counter overflow of gutters into the building. Consideration of overflow at high concentrations of water flow may need to be given. Guidance on this matter is given in NSW Dept of Fair Trading bulletin FTB40 (January 2009).

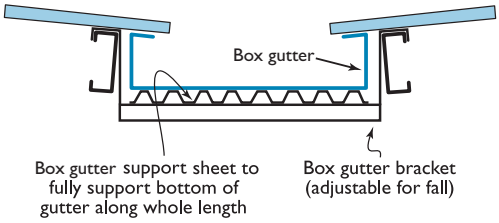
Install gutters with a suitable fall to avoid ponding and to allow water to easily flow away. Steeper falls are preferred for prolonged life of the gutter. More information can be found in our LYSAGHT 'Rainwater Solutions' publications for each Region. Refer to the BCA and the Australian Standards for more guidance.

Table 6.2.1
Design rainfall intensities

	For overflow of gutters once in 20 years mm/hour	For overflow of gutters once in 100 years mm/hour
A.C.T.		
Canberra	137	194
New South Wales		
Broken Hill	130	181
Bathurst	143	197
Sydney	214	273
Newcastle	181	233
Victoria		
Mildura	125	174
Melbourne	127	186
Ballarat	127	184
Queensland		
Brisbane	251	333
Rockhampton	248	336
Mackay	273	363
Mt. Isa	169	223
Townsville	260	346
Cairns	282	368
South Australia		
Mount Gambier	108	168
Adelaide	123	186
Western Australia		
Geraldton	132	173
Perth	146	214
Tasmania		
Hobart	99	155
Northern Territory		
Alice Springs	139	204
Darwin	285	366



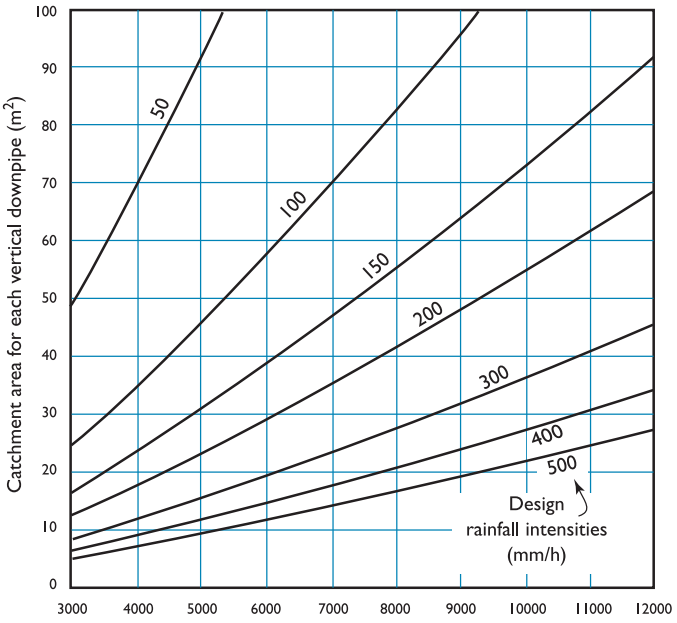
Eaves gutters



Box gutter

Figure 6.1.1
Typical gutters

Figure 6.2.2
Cross-sectional area of eaves gutters required for various roof catchment areas (where gradient of gutter is 1:500 and steeper). (Adapted from AS 3500.3:2003)



Example

Find the minimum catchment area for each downpipe on a house in Forbes using Quad Hi-front gutter.

METHOD

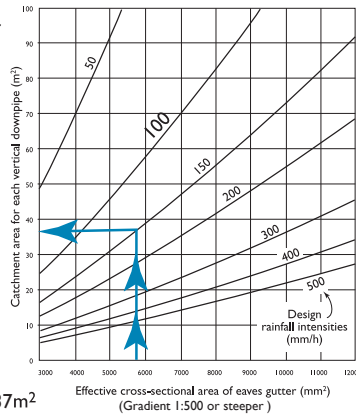
Using the gutter cross sectional area taken from Table 6.2.2 (shown across the bottom of the graph) draw a line upwards until it intersects with the Design rainfall intensity (Table 6.2.1). Draw a line at 90° to determine the catchment area for each downpipe.

DATA

Design rainfall intensity = 151 (B.C.A.)
Gutter area = 5804 (Table 6.2.2)

SOLUTION (from Table 6.2.2)

Catchment area for each downpipe = 37m²



Gutter, downpipe and accessory availability and details may vary locally. Reference should be made to the local LYSAGHT Rainwater Solutions brochure for your area.

Table 6.2.2
LYSAGHT gutter areas and downpipes

	Slotted	Effective# cross-section	Minimum standard downpipe sizes to suit gutters (gradient ≥ 1:500) Round (diameter)	Rectangular or square
	yes/no	mm²	mm	mm
COLONIAL	no	4465	n/a	45 x 95
EMLINE	yes	6723	100	100 x 75
EMLINE	no	9540	125	100 x 75
FITFAST	yes	6723	90	100 x 75
FITFAST	no	7209	90	100 x 75
FLAT BACK 150	yes	5220	90	100 x 75
FLAT BACK 150	no	6447	90	100 x 75
HALF ROUND 150	yes	4775	90	100 x 75
HALF ROUND 150	no	6995	90	100 x 75
OGEE	no	5242	-	100 x 50
QUAD 115 Hi-front	yes	5225	90	75 x 75
QUAD 115 Hi-front	no	5809	90	100 x 50
Hi-front fluted Qld.	yes	5285	90	75 x 75
Hi-front fluted Qld.	no	5809	90	100 x 50
QUAD 115 Low-front	no	6165	90	100 x 50
QUAD 150	no	8910	100	100 x 75
QUAD 175	no	14672	100	100 x 75
Square Bead Quad	no	5420	n/a	45 x 95
Quarter Round	no	5970	n/a	45 x 95
RANCELINE	no	5657	75	100 x 75
SHEERLINE	yes	7600	100	100 x 75
SHEERLINE	no	8370	100	100 x 75
TRIMLINE	yes	6244	100	100 x 75
TRIMLINE	no	7800	100	100 x 75

Values calculated in accordance with AS/NZS 2179.1:1994

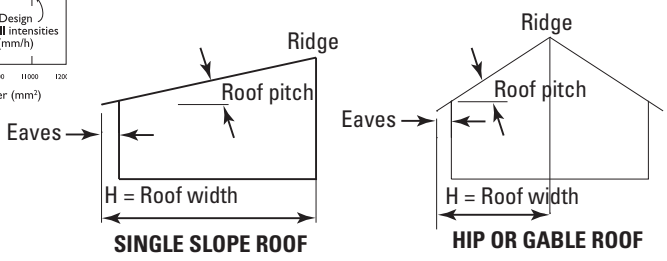


Table 3. LYSAGHT Gutter slot overflow capability

Rainfall Intensity	Rigid-fix		Flexiblefix	
	Catchment Area	Domestic 22°.5 pitched roof width "H"	Catchment Area	Domestic 22°.5 pitched roof width "H"
(mm/hr)	(m² perm run of gutter)	(m)	(m² perm run of gutter)	(m)
100	8.3	6.9	14.3	11.9
150	5.5	4.6	9.5	7.9
200	4.2	3.4	7.1	5.9
250	3.3	2.8	5.7	4.7
300	2.8	2.3	4.8	4.0
350	2.4	2.0	4.1	3.4
400	2.1	1.7	3.6	3.0

Notes:
1. Check with your local service centre for the availability of slots.
2. Slot overflow is based on test results.
3. The slot capacity is conservative and can be used for all gutters produced in NSW.
4. Flexible-fix refers to long straight runs of gutters. Rigid-fix refers to short length of gutters that are rigidly held in place by corners, downpipes, and the like.

7 General care, safety and handling

The following Section should be considered a guide only. For comprehensive information, building professionals should consult the appropriate legislation, regulations, codes of practice and technical literature such as HB39 and Lysaght technical bulletins.

7.1 Safety

It is commonsense to work safely, protecting yourself and workmates from accidents on the site. Safety includes the practices you use; as well as personal protection of eyes and skin from sunburn, and hearing from noise. Some sunscreens contain titanium oxides. These have been shown to break down some paint compounds and these should be avoided.

Occupational health and safety laws enforce safe working conditions in most locations. Laws in every state require you to have fall protection which includes safety mesh, personal harnesses and perimeter guardrails. We recommend that you are fully aware of all local codes of safe practice and you adhere strictly to all laws that apply to your site.

7.2 Care and storage before installation

Rain or condensation is easily drawn between the surfaces of stacked sheets by capillary action, or they can be driven in by wind. This trapped moisture cannot evaporate easily, so it can cause deterioration of the coating which may lead to reduced life-expectancy or poor appearance.

If materials are not required for immediate use, stack them neatly and clear of the ground and minimise the duration of exposure if left for extended periods. If left in the open, protect them with waterproof covers.

If stacked or bundled product becomes wet, separate it without delay, wipe it with a clean cloth and stack it to dry thoroughly.

7.3 Handling cladding on site

On large building projects you can reduce handling time by lifting bundles with a crane direct from the delivery truck onto the roof frame. Use a spreader bar for long sheets. For small to medium size projects, without mechanical handling facilities, you can unload sheets by hand and pass them up to the roof one at a time.

Handling Safety - our product may be sharp and heavy.

It is recommended that heavy-duty cut-resistant gloves and appropriate manual handling techniques or a lifting plan be used when handling material.

Handle materials carefully to avoid damage: don't drag materials over rough surfaces or each other; carry tools, don't drag them; protect from swarf.

7.4 Walking on roofs

It is important that you walk on roofing carefully, to avoid damage to either the roofing or yourself.

Generally, keep your weight evenly distributed over the soles of both feet to avoid concentrating your weight on either heels or toes. Always wear smooth soft-soled shoes; avoid ribbed soles that pick up and hold small stones, swarf and other objects.

When you walk parallel to the ribs:

- for ribbed roofing walk on at least two ribs or corrugations (CUSTOM ORB, CUSTOM BLUE ORB and SPANDEK);
- for pan-type roofing walk in the pans (LONGLINE 305, KLIP-LOK 406, KLIP-LOK 700HS, KLIP-LOK CLASSIC 700, SPANRIB, TRIMDEK, INTEGRITY 820).

When you walk across the ribs, walk over or close to the roofing supports. (Usually over fastener locations.)

Be careful when moving between supports. Do not walk in the pan immediately adjacent to flashings or translucent sheeting. Walk at least one pan away.

Always take particular care when walking on wet or newly laid sheets — particularly on steeply pitched roofs.

If there will be heavy foot traffic on a roof, provide a temporary walkway or working platform with consideration of hand rails to minimise damage.

7.5 Marking out, cutting and drilling

Marking out

A pencil of any colour may be used except black or so-called lead pencils. Don't use black pencils to mark roofing or walling because the graphite content can create an electric cell when wet and thus cause deterioration of the finish. You can also use a string line with chalk dust, or a fine, felt-tipped marker.

Cutting

Where possible, you should minimise site-work by using sheets cut to length in the factory.

For cutting thin metal on site, we recommend that you use a power saw with a metal-cutting blade because it produces fewer damaging hot metal particles and leaves less resultant burr than does a carborundum disc.

Alternative cutting tools (electric shears and nibblers) are also suitable however extra care with the straightness of the cut may be required.

Cut materials over the ground and not over other materials where hot particles can fall and cause damage to finishes—especially COLORBOND® prepainted finishes. It is best to have the exterior colour finish of a COLORBOND® prepainted sheet facing down, however you must then protect the paint finish from scratching by your work supports.

If you have to cut materials near sheets already installed, mask them or direct the stream of hot particles away. Reciprocating nibblers are also widely used in the roofing trade, and they produce an excellent cut.
The resulting small, sharp scraps can rust and damage finishes; and they can cause personal injury. Take special care to collect these scraps.

Making holes

Holes are often made by drilling or cutting by hole saw or jig saw. Mask the area around the hole to protect paint from damage by swarf.

7.6 Clean up

Swarf (metal scraps and/or abrasive particles resulting from cutting and drilling) left on the surfaces of materials will cause rust stains which can lead to reduced life of the material.

- Sweep or hose all metallic swarf and other debris from roof areas and gutters at the end of each day and at the completion of the installation. Failure to do so can lead to blockages of water flow or surface staining (such as when the metal particles rust).
- If swarf has become stuck on a finish, it can be removed. Take great care not to remove the paint or the metal coatings.
- For critical applications inspect the job two weeks after completion, when rain or condensation will have caused any remaining swarf to rust, and thus highlight affected areas.

7.7 Warn other contractors

Many stains arising from swarf do so, not from the work of roofing-installers, but from other contractors working on the job. Similarly, problems can arise from contact with incompatible materials, like copper piping or chemically treated timber. Acid cleaning of bricks can also be a problem. Remember to warn them to walk on pans, not on the ribs. Architects and builders need to be aware of all this, and warn contractors accordingly.

7.8 Strippable coatings

To provide temporary protection during production, handling and transport, some COLORBOND® products are coated with a plastic. This coating peels off easily when new, but it has a relatively short life, especially in sunlight. If you don't remove this coating at the time of installation, you may find it very hard to remove later on.

Please dispose of the plastic in an environmentally responsible manner.

7.9 Recommended sealants

Neutral-cure silicone sealants have been successfully used with the range of steel finishes on our roofing and walling; and on flashings, cappings, and gutters made from the same materials as the cladding.

Neutral-cure silicone sealants:

- have good adhesion to the clean surface of all our roofing and walling;
- are water resistant and non-corrosive;
- are resistant to extremes of heat and cold while retaining good flexibility;
- excellent gap fillers;
- provide high resistance to ultra-violet rays (sunlight); and
- have a long service life.
- They are NOT adhesives.

It is important that only neutral-cure silicone be used with sheet steel. Other silicone sealants, often have a vinegar or ammonia smell, and give off aggressive by-products during curing which are detrimental to sheet steel.

If in doubt, look for a message on the sealant package like: Suitable for use with galvanised and ZINCALUME® steel products.

Cleaning surfaces

For effective bonding, all surfaces must be clean, dry and free from contaminants such as old sealant or oil.

Mineral turpentine is suitable for cleaning the surfaces but care must be taken to completely remove all residual solvent with a clean dry cloth. White spirits is an alternative.

Sealant must be applied on the same day as the surface is cleaned.

Joint strength

Joints sealed with sealant should be mechanically fixed for strength. Spacing of the fixing will depend upon the type of joint to be sealed. Fasteners in joints of simple seams (flat sheet steel joints) should generally be no further apart than 50mm. Fasteners in joints with profiled roofing (e.g. side lap joints) can be spaced further apart. The spacing of the fasteners shall be based on good and accepted industry practices to ensure suitable bonding of the sealant to the mating surfaces.

The sealant does not require significant adhesive strength in itself, but it must bond positively to all the surfaces it is to seal. To ensure complete sealant cure, the width of sealant in a lap should not exceed 25mm when compressed (Figure 7.8.1).

Applying sealant

Always apply the bead of sealant in a continuous line along the centreline of the fastener holes. This ensures that, when compressed, the sealant positively seals the fastener.

Be careful not to entrap air when applying sealant. Especially, don't place a ring of sealant around fastener holes because entrapped air compresses during tightening of fasteners, and may blow a channel through the sealant, which could prevent the fastener from being sealed.

Fasteners

Use solid or sealed fasteners (e.g. screws and blind pop rivets), otherwise you have to apply sealant to the hollow centre of open pop rivets.

To preserve the life of your cladding, is very important that fastener materials are compatible with the cladding (Section 2.10).

Procedure

The preferred procedure for lap fabrication is:

1. Assemble, clamp and drill;
2. Separate components and remove drilling debris;
3. Clean joint surfaces as recommended above;
4. Apply bead(s) of sealant;
5. Relocate components and fix;
6. Externally seal each fastener if hollow blind rivets are used.

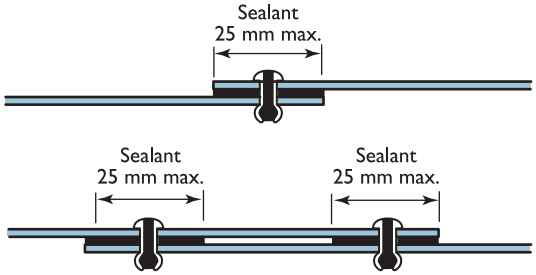


Figure 7.9.1
Typical joints with sealant

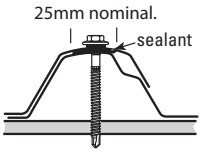


Figure 7.9.1.1
Typical crest with sealant

To prevent premature curing (which causes poor bonding), finish the joint as soon as practical after applying the beads of sealant. The manufacturer's specified sealant open times should be followed.

Sealant clean up

With practice you will be able to judge the size of beads thus avoiding squeeze-out and the subsequent need to clean up.

Uncured sealant can be removed with a clean, dry rag and any excess then removed with a cloth lightly dampened with mineral turpentine or white spirits. Excess cured sealant is best removed with a plastic spatula to avoid damage to the surface finish of the metal.

Avoid any unnecessary smearing of sealant on surfaces intended for painting as silicone can affect adhesion of paint. Smeared sealant may be treated by lightly abrading the area with a non-metallic scouring medium.

7.10 Maintenance

Factors that most affect the long life of a roof (or wall) are original design, the environment of the installation, and the maintenance of the installation. Maintenance is probably the biggest factor.

Maintenance includes:

- Regular inspection for problems before they become major corrosion sites;
- Regular washing down, especially near coastal or industrial influences;
- Removal of leaves and other debris from gutters, downpipes, leaf-guards, slots, holes and other overflow devices;
- Keep walls free of soil, concrete and debris near the ground;
- Don't overspray pesticide.

Maintenance of COLORBOND® prepainted steel

The paint system on COLORBOND® steel sheet is very durable. Simple maintenance of the finish enhances its life and maintains attractiveness for longer periods.

Where the paint finish is naturally washed by rainwater (roofs, for example) there is usually no additional maintenance needed. However areas to be washed include soffits, wall cladding under eaves, garage doors, and the underside of eave gutters.

Washing should be done at least every six months and more frequently in coastal areas where sea spray is prevalent, and in areas where high levels of industrial fallout occur. Avoid accumulation of salty deposits or industrial dirt.

Establish a regular routine for washing COLORBOND® prepainted steel products. Often garage doors can be washed with clean water at the same time as your car is being washed. Guttering and eaves can be hosed down when windows are being cleaned. Walls can be hosed down (if water restrictions permit) while watering the garden.

Where regular maintenance doesn't remove all the dirt, wash the surface with a mild solution of pure soap or non-abrasive non-ionic kitchen detergent in warm water. Use a sponge, soft cloth or soft bristle nylon brush; be gentle to prevent shiny spots. Thoroughly rinse off the detergent with clean water.

Never use abrasive or solvent cleaners (like turps, petrol, kerosene and paint thinners) on COLORBOND® steel surfaces. For advice on grease, oil or deposits not removed by soap or detergent contact our Information Service.

8 Installing pierce-fixed cladding

Pierce-fixing is the method of fixing sheets using fasteners which pass through the sheet. This is different from the alternative method called concealed-fixing (Chapter 9). The method of fixing you use is determined by the cladding profile you are using.

You can place screws through the crests or in the pans/valleys, however, to maximise watertightness, always place roof screws through the crests. For walling, you may fix through either the crest or valley/pan (Figure 8.1).

Always drive the screws perpendicular to the cladding, and in the centre of the corrugation or rib.

The following procedures are described for roofs, but the same general principles apply to walls.

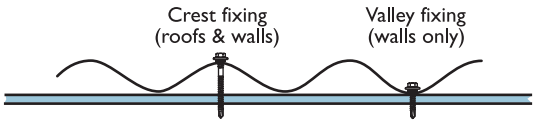


Figure 8.1
Crest and valley fixing (CUSTOM ORB)

8.1 General installation procedure

Check flatness, slope and overhang

Before starting work ensure that:

- the supports for your cladding are truly in the same plane;
- the minimum roof slopes conform to Section 2.5 (Low-roof-pitches); and
- the overhangs of sheets from the top and bottom supports don't exceed those in Table 2.12.1 and Table 2.13.1, whilst also overhanging a nominal length into gutters.

Make any necessary adjustments before you start laying sheets, because they will be difficult or impossible to rectify later.

Orient sheets before lifting

For maximum weathertightness, start laying sheets from the end of the building that will be in the lee of the worst-anticipated or prevailing weather (Figure 8.1.1).

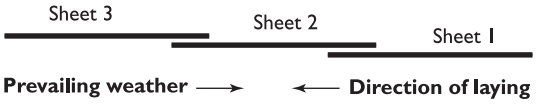


Figure 8.1.1
Lay sheets towards prevailing weather

It is much easier and safer to turn sheets on the ground than up on the roof. Before lifting sheets on to the roof, check that they are the correct way up and the overlapping side is towards the edge of the roof from which installation will start.

Place bundles of sheets over or near firm supports, not at mid span of roof members.

Position first sheet

With particular care, position the first sheet before fixing to ensure that it is correctly located in relation to other parts of the building.
Check that the sheet:

- is aligned with the end-wall (or its barge or fascia), bearing in mind the type of flashing or capping treatment to be used; and
- aligns correctly at its ends in relation to the gutter and ridge (or parapet or transverse wall).

Fix the sheet as described later in this chapter.

Position other sheets

After fixing the first sheet in position, align the following sheets using:

- the long edge of the previous sheet; and
- a measurement from the end of the sheet to the fascia or purlin at the gutter. It is important that you keep the gutter-end of all sheets in a straight line.

Fix the sheet by either:

- fixing each sheet completely, before laying the next; or
- fix the sheet sufficiently to ensure it can't move, complete laying all sheets, then return to place all the intermediate fasteners later.

Check alignment occasionally

Occasionally check that the sheets are still parallel with the first sheet, by taking two measurements across the width of the fixed cladding (Figure 8.1.2).

At about half way through the job, perform a similar check but take the measurements from the finishing line to aim for the final sheet to be parallel with the end of the roof. If the measurements are not close enough, lay subsequent sheets very slightly out of parallel to gradually correct the error by:

- properly align and fix a lap, then
- fix the other edge of the sheet, placing the fasteners slightly closer or further from where they would normally be if there was no error. (Gradually correct the error by placing the fasteners in such a way as to slowly bring the sheets back into correct alignment.)

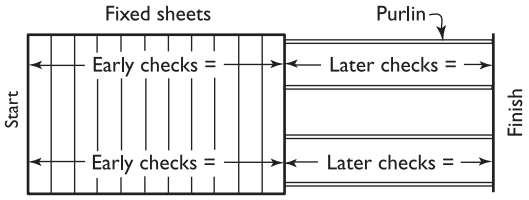
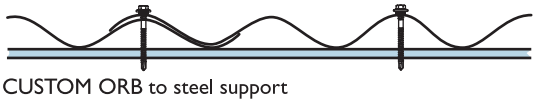
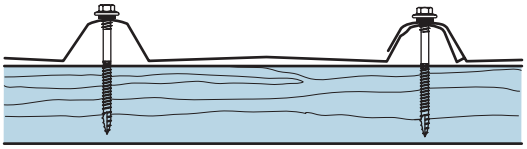
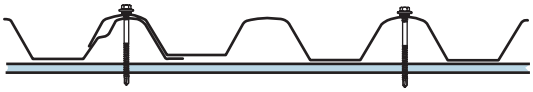


Figure 8.1.2
Check alignment occasionally


CUSTOM ORB to steel support


TRIMDEK to timber support
Typical also of INTEGRITY (see detail)


SPANDEK to steel support

8.2 Side-lapping & positioning pierce-fixed sheets

To prevent moisture being drawn into laps by capillary action, the edges of sheets are slightly modified. CUSTOM ORB and CUSTOM BLUE ORB have the edges of the sheet over-curved, other products like SPANDEK, TRIMDEK, INTEGRITY 820 and SPANRIB all have flutes formed into the underlapping rib. It is important that sheets be lapped correctly. This means there should only be one overlap/underlap - double lapping is not recommended. (Figure 8.2.1)

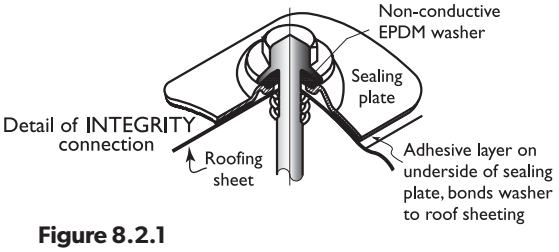


Figure 8.2.1
Crest fixing

After fixing the first sheet, place the next (and subsequent) sheet with its side lap snugly over the previous sheet (Figure 8.2.1). Secure the sheet firmly in place until each end of the sheet has been fixed.

You can do this easily by:

- align the bottom edge accurately by a measurement from the end of the sheet to the fascia or purlin at the gutter;
- clamp the lap with a pair of vice grips (Figure 8.2.2);
- at the top of the sheet: nestle the side lap snugly, check alignment, and fix the sheet with a fastener.

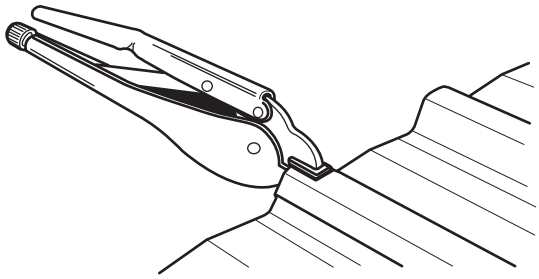


Figure 8.2.2
Clamp one end of the sheet whilst fixing the other end.

8.3 Pierce-fixing on crests

Crest fixing is recommended for roofs made from:

- CUSTOM ORB
- CUSTOM BLUE ORB
- SPANDEK
- TRIMDEK
- INTEGRITY 820
- SPANRIB

Crest fixing may also be used for these products when they are used as walling.

8.4 Pierce-fixing on valleys (for walling only)

Wall fasteners may be placed on the crests, but they are usually placed in the valley of wall cladding because:

- they are less conspicuous and don't break the aesthetic lines of the steel cladding;
- there is no risk of the profile being deformed, because the fastener is placed through the cladding where it rests flat against its support (Figure 8.4.1); and
- water penetration is not a problem.

However, when valley-fixed, the cladding needs a side-lap fastener in all laps, at each support. You will find it more economical in labour, time and cost of fasteners to use a crest fastener at each side lap in place of the lap fastener and adjacent valley fastener (Figure 8.4.2).

8.5 Pierce-fixing on side-laps

Where roofing is installed according to the support spacings shown in Tables 2.12.1 and/or 2.13.1, side-lap fasteners are generally not required.

You may need to use side-lap fasteners where the cladding is laid a little out of alignment, where the weather resistance of a joint is questionable, at the end of overhangs, where insulation results in the lap opening, or for any number of reasons. Decide on the number of side-lap fasteners by what looks effective in each individual case.

The side-laps of shallow roof profiles on curved roofs (convex and concave) would be considered to have reduced weather resistance, and especially over the crest of the roof due to inadequate drainage from insufficient slope. It is common industry practice to provide side-lap fastening over the curved roof and in particular over the crest region where sealant is used.

Typical practice is to space the side-lap fasteners at 900mm maximum.

For cyclonic regions where resistance against flying debris is required the maximum recommended spacing of side-lap fasteners is 600mm.

Where valley fasteners are used (walling), you need side-lap fasteners along each lap at each support. Alternatively a crest fastener may be used at each side-lap, in place of the side-lap fastener and adjacent valley fastener (as mentioned above in Section 8.4).

Side-lap fasteners are located in the centre of the crest of the overlapping rib (Figures 8.4.1 and 8.4.2)

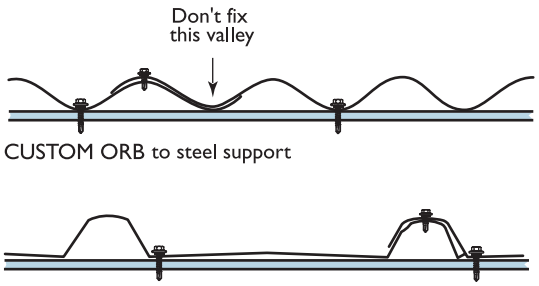


Figure 8.4.1
Typical valley fixing (for walls only)

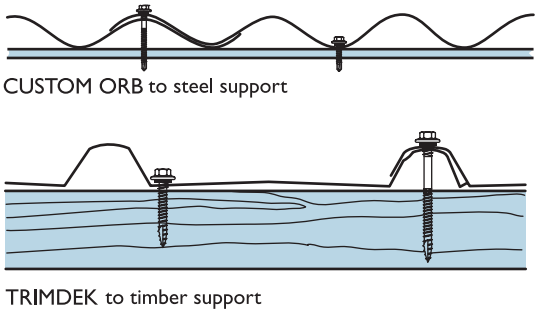


Figure 8.4.2
Alternative valley/pan fixing with crest fixing at side laps (for walls only)

9 Installing concealed-fixed cladding

Concealed-fixing is the method of fixing sheets using fasteners which do not pass through the sheet. Instead, the cladding is held in place with clips. This is different from the alternative method called pierce-fixing (Chapter 8). The method of fixing you use is determined by the cladding profile you are using.

Concealed-fixing is used for:

- KLIP-LOK 700 HI-STRENGTH
- KLIP-LOK CLASSIC 700
- KLIP-LOK 406
- EASYCLAD
- LONGLINE 305

Very steep pitches

To prevent concealed-fixed cladding from sliding downward in the fixing clips, on very steep pitches, you should pierce-fix through each sheet under the flashing or capping, along the top of the sheets, but not less than 25mm from the ends of a sheet.

9.1 Installing KLIP-LOK roofs

Use the same general procedure described in Section 8.1 (General installation procedure). However, at the start of installing KLIP-LOK 406, KLIP-LOK CLASSIC 700 (KL-CLASSIC) or KLIP-LOK 700 HI-STRENGTH (KL-700HS) a row of clips is fixed to the supports before the first sheet is located over them and locked in position.

Clips

KLIP-LOK 700HS use KL-700HS clips.

KLIP-LOK CLASSIC 700 use KL-CLASSIC 700 clips.

For KLIP-LOK 406 use KL-65 clips.

The orientation of the clips is important because they are not symmetrical (Figure 9.1).

The fixing holes are pre-punched. On KL65 clips you can use the dimples to locate other fasteners where a fastener breaks or a timber support splits.

As there are differences in installation procedures, each type of KLIP-LOK will be presented separately.

9.2 Installing KLIP-LOK walls

In walling applications, horizontal pressure will need to be applied locally to the sheets to engage the ribs. Use body pressure (torso, hand or foot) or use a rubber mallet if required. Care should be exercised due to the potential instability of the temporary worker access equipment.

To prevent KLIP-LOK from sliding downward in the fixing clips, you should pierce-fix through each sheet under the flashing or capping, along the top of the sheets.

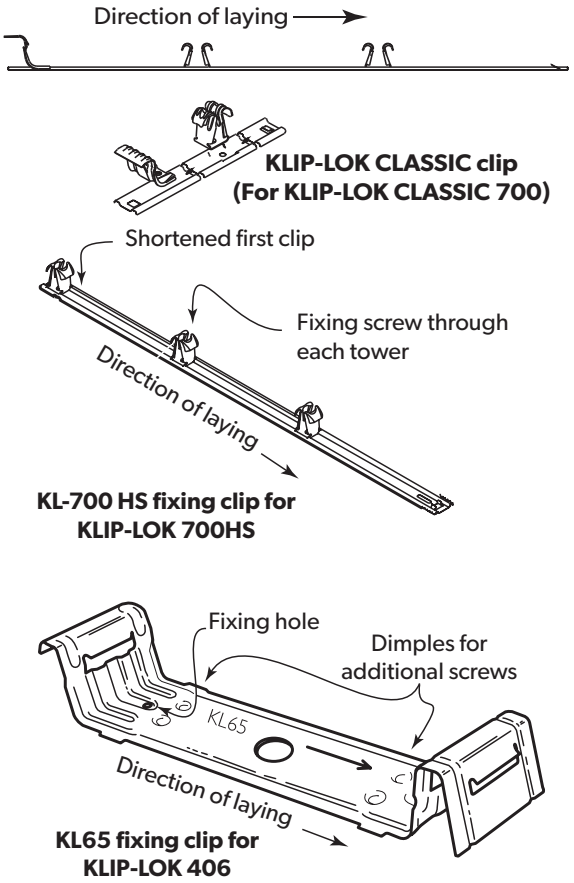


Figure 9.1
KLIP-LOK clips

KLIP-LOK 700 HIGH STRENGTH® Installation

KLIP-LOK 700 HI-STRENGTH Preparation

Before starting work ensure that:

- check flatness, slope and overhang;
- orient the sheets before lifting. Note the overlapping rib is towards the end of the building where you start;
- Check that the overhang of the sheets from the clips, at both eaves and ridge, is not less than the minimum permitted.
- The first and the last supports and clips should be at least 75mm from each end of the sheet to keep maximum holding power.

Make any necessary adjustments before you start laying sheets, because they will be difficult to rectify later.

Orient sheets before lifting

Consider which end of the building is best to start from. For maximum weather-tightness, start laying sheets from the end of the building that will be downwind of the worst-anticipated or prevailing weather (Figure 9.1.1).

It is much easier and safer to turn sheets on the ground than up on the roof. Before lifting sheets on to the roof, check that they are the correct way up and the overlapping side is towards the edge of the roof from which installation will start.

Place bundles of sheets over or near firm supports, not at mid span of roof members.

Starting method 1. Cut the 1st clip 25mm from the centre of the second tower (as shown). The first tower on the cut clip locates in the 1st rib of the first sheet (Figure 9.1. 2) but you must fix two clips at the start.

Starting method 2. The first tower on the first clip locates in the first rib of the first sheet (Figure 9.1.2). The clip fixes the edge of the first sheet.

Steps for installation

1 Lay and fix wire mesh to the supports in accordance with the appropriate building requirements.

2 Position the first clips on each support by placing onto the support nearest the roof edge. (Figure 9.1.3)

3 Fix the first clip on the support so they point in the direction of laying. Ensure the clip is 90 degrees to the edge of the sheet.

4 Align the clips using a string line (or the first sheet as a straight edge) to align the clips as you fix a clip to each support working towards the high end of the roof.

5 Drive hex-head screws through the top of the clip, into the support.

6 Work along the edge of the roof ensuring it aligns correctly at its ends in relation to the gutter and ridge (or parapet or transverse wall).

7 Position the first sheet so that it overhangs the desired amount to the gutter. It is important to ensure this first sheet is placed square to adjacent edges. (Figure 9.1.4.)

8 Engage the sheet with clips using vertical foot pressure on all the ribs over each clip.

9 Fix the next row of clips, one to each support with the slots and tabs engaged. Be sure the clip is 90 degrees to the edge of the sheet. It is good practice to bend down the tabs once engaged. This can be done with the bit of a screw gun.

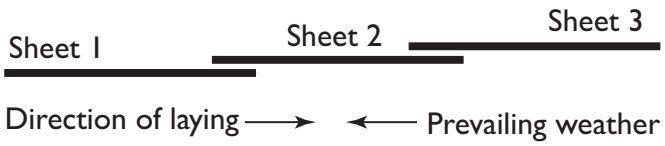
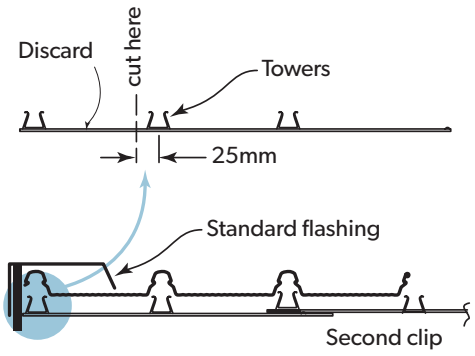
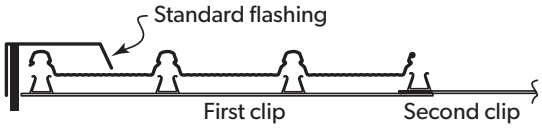


Figure 9.1. 1
Lay sheets towards prevailing weather

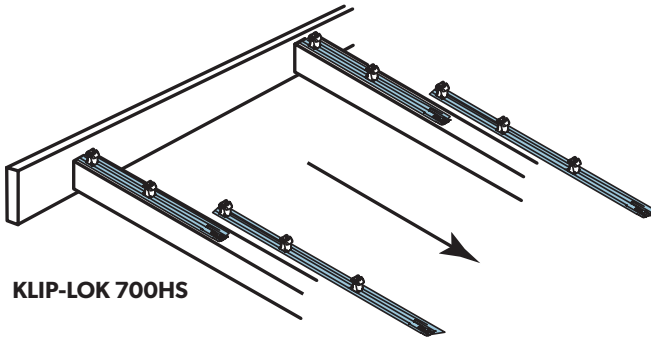


KLIP-LOK 700HS: Starting method 1



KLIP-LOK 700HS: Starting method 2

Figure 9.1.2
Alternative methods for first clips



KLIP-LOK 700HS

Figure 9.1.3
Fix the first row of clips. Fix the next (and subsequent) clips and sheets

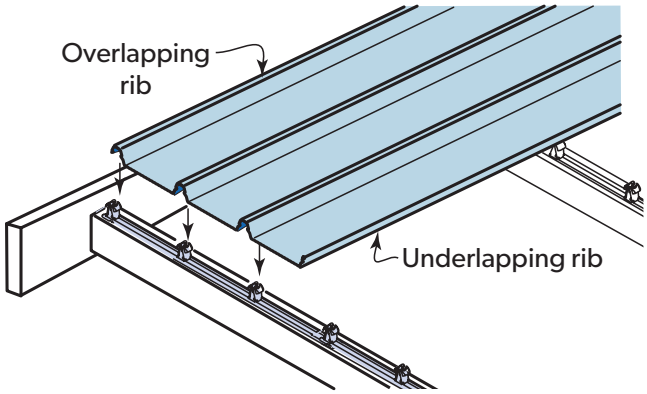


Figure 9.1.4
Placing the first sheet

10 As before, place the next sheet over its clips ensuring you also engage the edge of the preceding sheet.

11 Accurately position the sheet so that it overhangs the desired amount into the gutter. It is important that you keep the gutter-end of all sheets in a straight line.

12 Fully engage the two sheets along the overlapping rib. You can do this by walking along the full length of the sheet with one foot in the centre pan of the previous sheet and the other foot applying vertical pressure to the top of the interlocking ribs at regular intervals. It is important that you don't walk in the unsupported pan beside the overlap. (Figure 9.1.5)

    With long spans, additional case may be required to ensure the overlapping rib adequately engages onto the underlapping leg. Care should be exercised due to the potential instability of the side lap when it is not adequately engaged (interlocked).

13 Similarly, engage all the clips by applying vertical foot pressure to the top of the other two ribs over each clip.

It is essential that the sheets interlock completely. It is important that your weight is fully on the sheet you are installing.

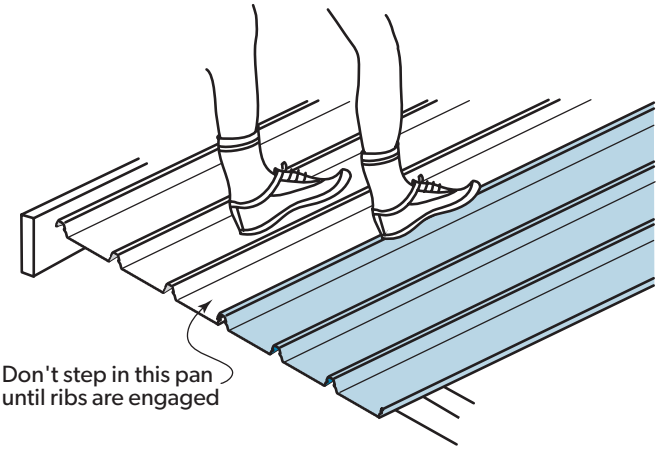


Figure 9.1.5
Engaging the lapping ribs

Check alignment occasionally

Occasionally check that the sheets are still parallel with the first sheet, by taking two measurements across the width of the fixed sheeting.

At about half way through the job, perform a similar check but take the measurements from the finishing line to aim for the final sheet to be parallel with the end of the roof. If the measurements are not close enough, lay subsequent sheets very slightly out of parallel to gradually correct the error (Figure 9.1.6) Therefore, to allow this to happen, flatten the tabs on the base of subsequent clips—the slot in the clip will allow the clips to be fixed out of standard pitch.

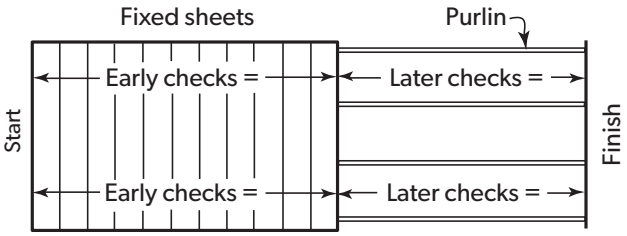


Figure 9.1.6
Check alignment occasionally

Fix the last sheet

If the final space is less than the full width of a sheet, you can cut a sheet along its length and shorten the clips as appropriate.

KLIP-LOK CLASSIC® 700 Installation

KLIP-LOK CLASSIC 700 Preparation

Before starting work ensure that:

- The supports for your cladding are truly in the same plane, this is critical if the roof slope is ≤ 5°
- The minimum roof slopes conform to our recommendations
- The overhangs of sheets from the top and bottom supports don't exceed our recommendations.
- The first and last supports and clips should be at least 75mm from each end of the sheet to keep maximum holding power.

Make any necessary adjustments before you start laying sheets, because they will be difficult to rectify later.

Orient sheets before lifting

Consider which end of the building is best to start from. For maximum weather-tightness, start laying sheets from the end of the building that will be downwind of the worst-anticipated or prevailing weather (Figure 9.1.7).

It is much easier and safer to turn sheets on the ground than up on the roof. Before lifting sheets on to the roof, check that they are the correct way up and the overlapping side is towards the edge of the roof from which installation will start.

Place bundles of sheets over or near firm supports, not at mid span of roof members.

KLIP-LOK CLASSIC 700 Installation

1 Lay and fix wire mesh to the supports and glass wool insulation in accordance with the appropriate building requirements.

2 Position the first clips on each support by placing onto the support nearest the roof edge. (Figure 9.1.8)

3 Fix the first clip on the support so they point in the direction of laying. Ensure the clip is 90 degrees to the edge of the sheet.

4 Align the clips using a string line (Figure 9.1.9) or the first sheet as a straight edge to align the clips as you fix a clip to each support working towards the high end of the roof.

5 Drive hex-head screws through the top of the clip, into the support.

6 Work along the edge of the roof, ensuring it aligns correctly at its ends in relation to the gutter and ridge or parapet or transverse wall.

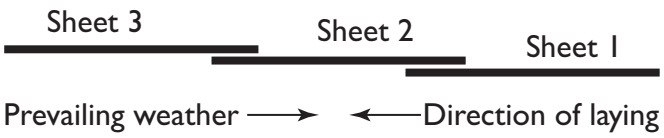


Figure 9.1.7
Lay sheets towards prevailing weather

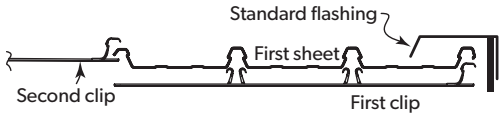


Figure 9.1.8
Sequence of laying

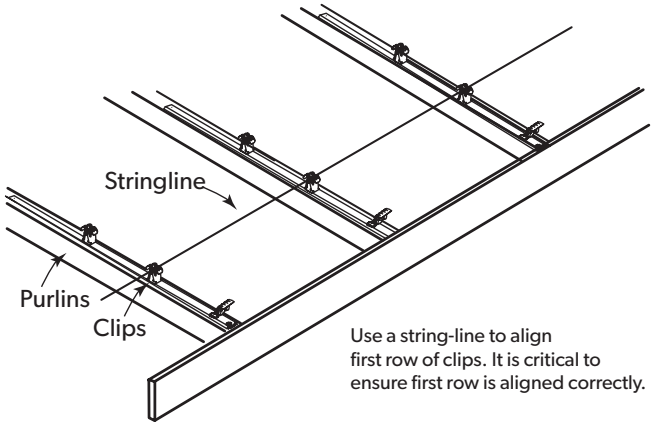


Figure 9.1.9
Use a stringline to ensure first row of clips is aligned. Fix first row of clips.

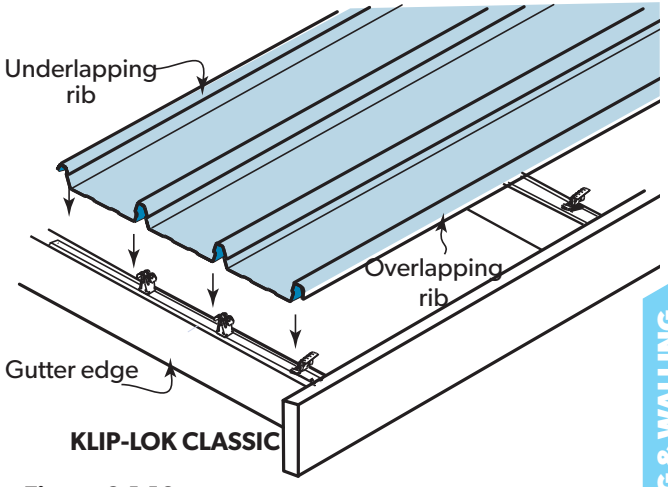


Figure 9.1.10a
Placing the first sheet

Figure 9.1.10b Position the 'S' clips over the male lapping rib of the cladding.

7 Position the first sheet so that it overhangs the desired amount to the gutter. It is important to ensure this first sheet is placed square to adjacent edges. (Figure 9.1.10)

8. Engage the sheet with clips using vertical foot pressure on all the ribs over each clip.

9. Fix the initial overlapping rib of the first sheet using an 'S' clip. (See Figure 9.1.10b)

10. Fix each next row of clips one to each support by engaging the front of the clip assembly onto the underlap rib of the preceding sheet engaging the spur of the clip to the leading edge of the previous sheet. (Figure 9.11.1 & 9.1.12) Be sure the clip is at 90° to the edge of the sheet.

11. As before, place the next sheet over its clips ensuring you also engage the edge of the preceding sheet.

12. Fully engage the two sheets along the overlapping rib. You can do this by walking along the full length of the sheet with one foot in the centre pan of the previous sheet and the other foot applying vertical pressure to the top of the interlocking ribs at regular intervals. It is recommended that you don't walk in the unsupported pan beside the underlapping rib. (Figure 9.1.13)

    With long spans, additional care may be required to ensure the overlapping rib adequately engages onto the underlapping leg. Care should be exercised due to the potential instability of the side lap when it is not adequately engaged (interlocked).

13. Similarly, engage all the clips by applying vertical foot pressure to the top of the other two ribs over each clip. It is essential that the sheets interlock completely. It is important that your weight is fully on the sheet you are installing.

14. Fit an 'S' clip at the last rib of the profile (similar to Step 9 when the sheet was started). Both starting and finishing requires an 'S' clip.

Check alignment occasionally

Occasionally check that the sheets are still parallel with the first sheet, by taking two measurements across the width of the fixed sheeting. At about half way through the job, perform a similar check but take the measurements from the finishing line to aim for the final sheet to be parallel with the end of the roof. If the measurements are not close enough, lay subsequent sheets very slightly out of parallel to gradually correct the error. (Figure 9.1.14)

Fix the last sheet

If the final space is less than the full width of a sheet, you can cut a sheet along its length and shorten the clips as appropriate. It is desirable to fix the sheet at one end.

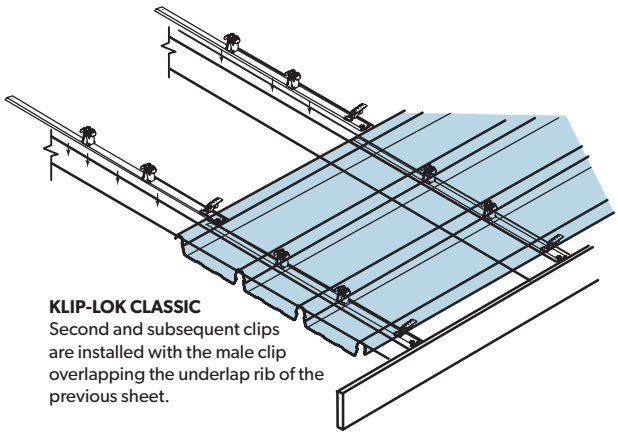


Figure 9.1.11
Fix the next (and subsequent) clips and sheets

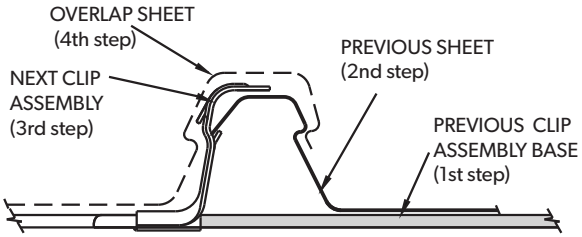


Figure 9.1.12
Engaging the next clip to the first sheet

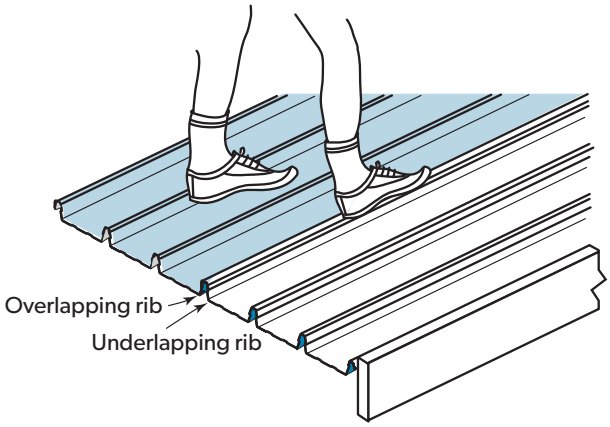


Figure 9.1.13 Engaging the lapping ribs

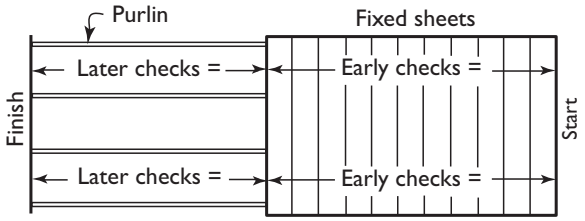


Figure 9.1.14
Check alignment occasionally

KLIP-LOK®406 Installation

KLIP-LOK 406 Preparation

Before starting work ensure that:

- Check that the top faces of all purlins or battens are lying in one plane, adjusting as necessary by packing or easing between these members and their supporting structure. Under no circumstances should packing be used directly under the fastening clips to adjust fall or alignment of roof.
- The minimum roof slopes conform to our recommendations; and
- The overhangs of sheets from the top and bottom supports don't exceed our recommendations.
- The first and last supports and clips should be at least 75mm from each end of the sheet to keep maximum holding power.
- Make spot checks for the alignment of sheets during laying to control fanning or creep (5 sheets = 2030mm coverage). To rectify alignment, sheets may be adjusted 2mm by pulling the clip away or pushing towards the sheet while fastening the clip.
- For very steep roof or vertical wall applications, a positive fastener (screw or bolt) is required in each sheet length to prevent movement down the fastening clips. This is best positioned under or through the flashing or capping at the top end.
- KLIP-LOK 406 can be fastened over insulation wool blankets up to 50mm thick when the blanket is draped over supports before installation of clips.
- Sheets should project into the gutter line.

Accurate alignment ensures efficient locking of sheets and clips. Conversely, misalignment can interfere with the locking action, particularly on close support centres. Make any necessary adjustments before you start laying sheets, because they will be difficult to rectify later.

Steps for Installation

Step 1

When lifting sheet lengths onto the roof frame ready for installation, make sure all sheets have the overlapping ribs facing towards the side where fastening is to commence. (Figure 9.1.15)

The first run of clips must be located and fastened, one to each support, so that they will correctly engage in the overlapping and centre ribs of the first sheet when it is located and locked over them. To do this, fasten clips to the purlins at each end of the sheet, having positioned them so that the first sheet will be in correct relation to other building elements. Align and fasten the remainder of the first run of clips using a string line or the first sheet as a straight edge.

Step 2

Position the first sheet longitudinally in relation to gutter overhang and locate it over the fastened run of clips, positioning the centre rib first, and engage the centre and overlapping ribs onto all clips by foot pressure. (Fig. 9.1.18)

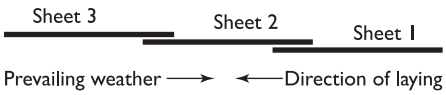
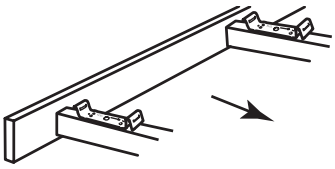


Figure 9.1.15
Lay sheets towards prevailing weather



KLIP-LOK 406
(KL65 clips shown)

Figure 9.1.16
Starting method for KL-406.

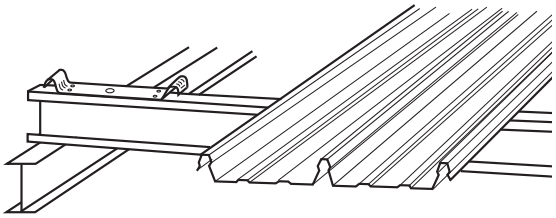


Figure 9.1.17
Orient the sheets correctly before installation on clips.

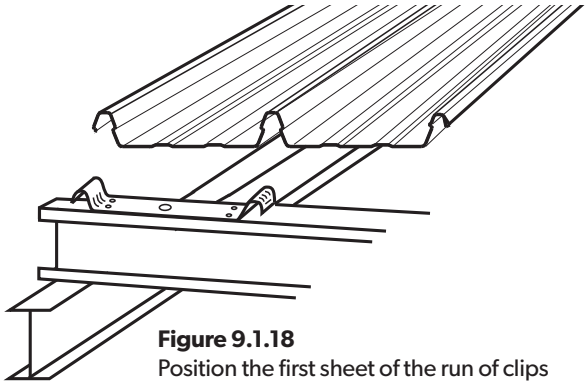


Figure 9.1.18
Position the first sheet of the run of clips

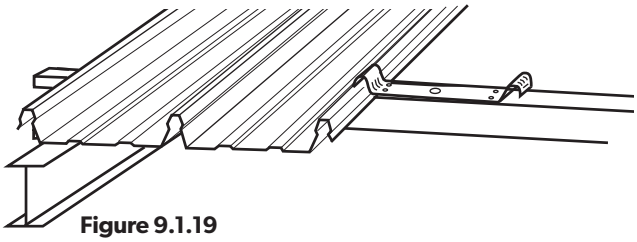


Figure 9.1.19
Position the next row of clips over the underlapping rib of the first sheet and fix clip to supports.

Step 3

Position and fasten the next run of clips, one to each support, with the short return leg of the clip over the underlapping rib of the installed sheet. (Figure 9.1.19)

If the clip fouls one of the spurs spaced along the outer free edge of the underlapping rib, the spur can be flattened with a blow from a rubber mallet to allow the clip to seat down over the rib.

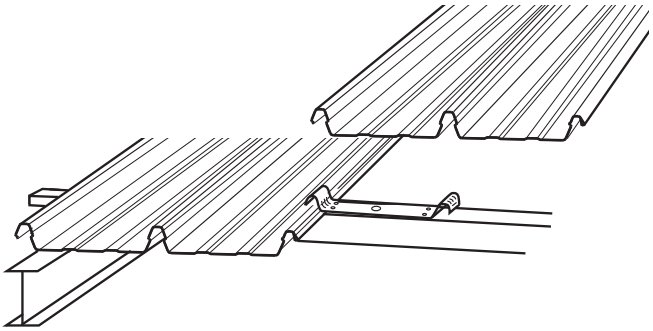


Figure 9.1.20
Lay the next row of sheeting over the next row of clips.

Step 4

Place the second sheet over the second run of clips, again positioning the centre rib first. A string line stretched across the bottom alignment of the sheets can be used to check that the ends of the sheets are in line. (Figure 9.1.20)

Fully engage the interlocking ribs and the centre rib over each clip. (Figure 9.1.21)

This can be achieved by walking along the full length of the sheet being installed with one foot in the tray next to the overlapping rib and the other foot applying pressure to the top of the interlocking ribs at regular intervals.

Also apply foot pressure to the top of the centre rib over each clip. For complete interlocking, which is essential, the spurs of KLIP-LOK 406 along the underlapping rib must be fully engaged in the shoulder of the overlapping rib.

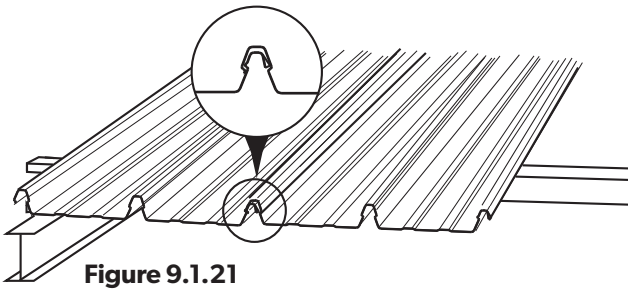


Figure 9.1.21
Engaging the lapping ribs

A distinct "click" will be heard as the interlocking ribs fully engage.

When engaging KLIP-LOK 406 interlocking ribs, stand only on the sheet being installed, that is the overlapping sheet, and not on the preceding sheet.

Install subsequent sheets by following Steps 3 and 4 and make periodic checks that the installed sheets are aligned with the roof perimeter.

Step 5

If the space left between the last full sheet and the fascia or parapet is more than a half sheet width, a sheet can be cut longitudinally, leaving the centre rib complete. This partial sheet can be fully clipped onto a row of clips as for a full sheet, before installing the capping or flashing. If the space left between the last full sheet and the fascia or parapet is less than a half sheet width, it can be covered by the capping or flashing. In this case, the last sheet should be secured by cutting sheet in halves and fastening the underlapping rib at each purlin with a half sheet. (Figures 9.1.22 & 9.1.23)

Similarly, a half clip may also be used if required. In this case, where a partial sheet of less than two ribs is used, it is necessary to turn up the lip along the edge of the cut sheet.

This can then be covered by the capping or flashing.

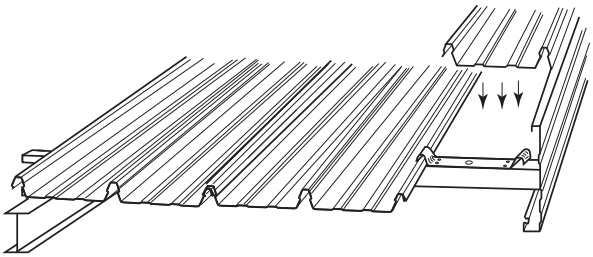


Figure 9.1.22
KLIP-LOK 406
Placing last sheet where half a sheet will fit

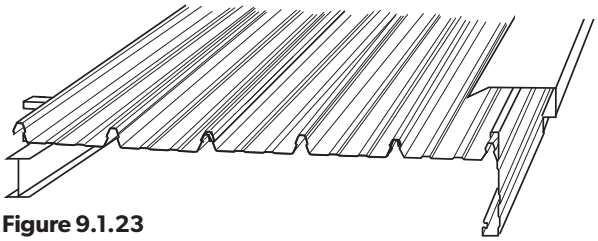


Figure 9.1.23
KLIP-LOK 406
Placing last sheet where half a sheet won't fit

EASYCLAD® Installation

9.3 Installing EASYCLAD

You can use EASYCLAD for walls, soffit linings or ceilings. Use a similar installation procedure for all.

EASYCLAD (2 pans per sheet) are pierce-fixed through the underlapping edge of each sheet. The fasteners in one sheet are concealed by the leading edge of the next. For the last sheet, a trim channel is used.

If you are using EASYCLAD with the ribs horizontal, start installing from the bottom of the wall so that the joints between panels tend to shed water (Figure 9.3.6).

You can use either of two methods to fix the first panel: a CD39 trim channel or CD40 starting clips.

Start method 1 – Using a trim channel on walls

With particular care, fix a trim channel at each support. Be careful to locate it correctly in relation to other parts of the building (see Section 8.1 Position first sheet).

- Use trim channel CD39 with EASYCLAD.

The first EASYCLAD panel is held in place by fitting it into the fixed trim channel (Figure 9.3.1).

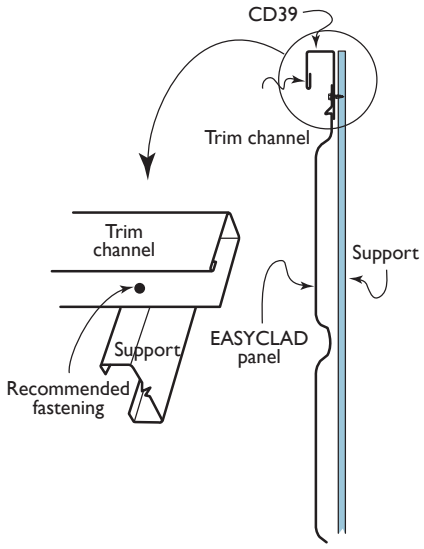


Figure 9.3.1
Using a trim channel to start

Start method 2 – Using clips on walls

With particular care, fix starting clips at each support. Be careful to locate them correctly in relation to other parts of the building (see Section 8.1 Position first sheet).

Hook the lip of an EASYCLAD sheet under these clips (Figure 9.3.2).

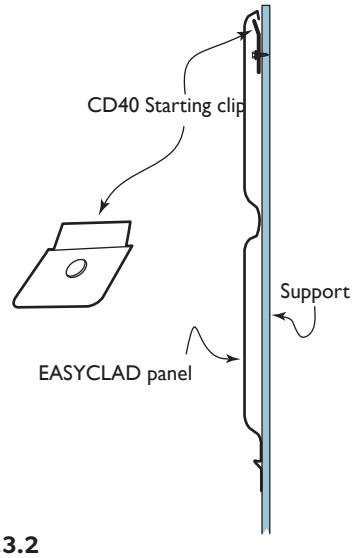


Figure 9.3.2
Using a clip to start

Fixing Easyclad panels

Locate the first panel either in its trim channel or under the clips (depending on the start method you used).

Fix the underlapping side of the panel, to each support, through the flat edge, with the recommended fastener (Chapter 3). The indentations along the edge help you locate the fasteners (Figure 9.3.3).

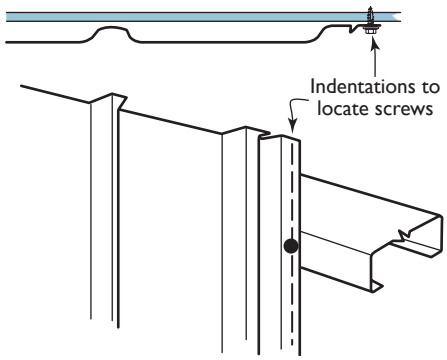


Figure 9.3.3
Indents on edge of sheet help to locate screws

Fit subsequent panels by hooking the lip of your next sheet under the folded-back edge of the previous panel before fixing in the same way as before (Figure 9.3.4).

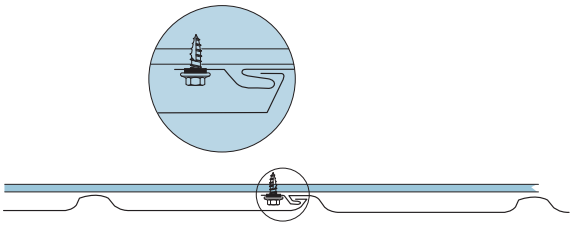


Figure 9.3.4
Starting for subsequent sheets

Usually the last EASYCLAD panel will have to be cut in width to suit the building. The panel may require exposed pierce-fixing. If you use a trim channel at the end of the EASYCLAD walling, position it and pierce-fix with the last panel (Figure 9.3.5).

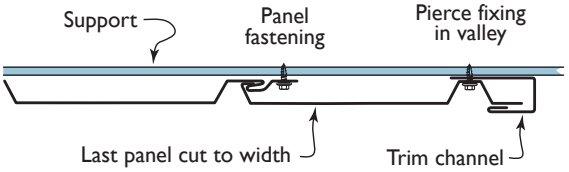


Figure: 9.3.5
Using trim channel to finish

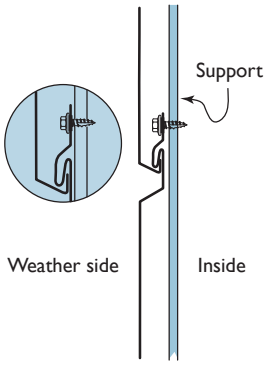


Figure 9.3.6
Start external walls from the bottom

LONGLINE 305® Installation

9.4 Installing LONGLINE 305 roofs

For LONGLINE 305 (standard width, fluted or tapered) use the same general procedure described in Section 8.1 (General installation procedure). However, at the start of installing LONGLINE 305, a row of clips is fixed to the supports before the first sheet is located over them and locked in position.

Preparation

Before starting, check that the supports on which your sheeting will rest are in the same plane; that the pitch and overhangs conform to the minimum specifications.

Orient sheets before lifting

Consider which end of the building is best to start from. So that side laps are protected, we recommend that you start laying sheets from the end of the building that will be in the lee of the worst anticipated or prevailing weather.

It is much easier and safer to turn sheets on the ground than up on the roof. Before lifting sheets on to the roof, check that they are the correct way up and the overlapping side is towards the edge of the roof from which installation will start.

Place bundles of sheets over or near firm supports, not at mid span of roof members.

Prepare clips

Cut all starting/finishing clips and discard the unwanted pieces. (Figure 9.4.1)

Fix the first row of clips

With particular care, determine the location of the first sheet and mark the edge of the sheet on the purlins.

Fix the first starting clip on the purlin. Using a string line (or the first sheet as a straight edge) fix the other starting clips for the first sheet on each purlin.

Place the first sheet

1. Locate the first sheet over the fixed starting clips (Figure 9.4.2).
2. Using a measurement from the gutter-end of the sheet to the fascia or purlin, position the sheet so that it overhangs the desired amount into the gutter.

   When setting the first sheet, remember that it is important you keep the gutter-end of all sheets at a constant distance from the edge of the gutter or fascia.
3. Bend the tab of all clips over the rib (Figure 9.4.3).

Fix the next (and subsequent) clips and sheets

1. Using the rib closing tool, squash the male rib of the first (previous) sheet at each purlin where the top fixing clips will fit (Figure 9.4.4).
2. Place top fixing clips over each squashed male rib and fix to the purlins (Figure 9.4.5). With a felt-tipped pen, make a small mark in the pan to enable you to locate the clips in the later locking operation with the button punch (Figure 9.4.6).
3. Place the next sheet over the edge of the preceding sheet (Figure 9.4.5).

   Accurately position the sheet so that it overhangs the desired amount into the gutter.

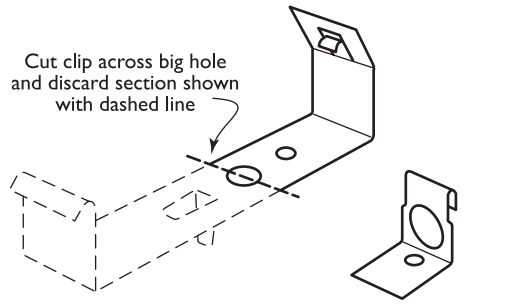


Figure 9.4.1
LONGLINE 305 clips

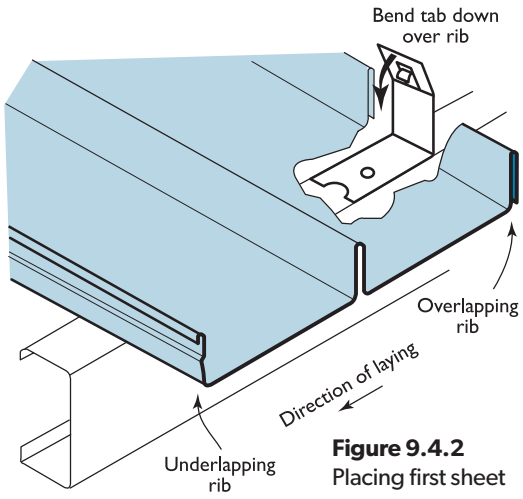


Figure 9.4.2
Placing first sheet

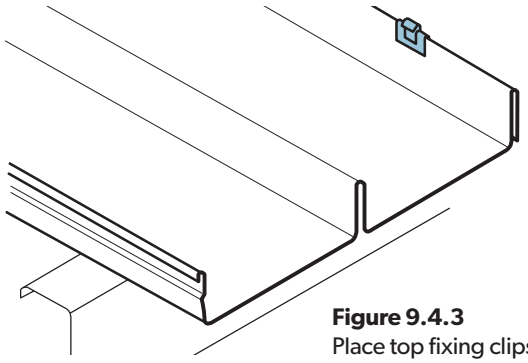


Figure 9.4.3
Place top fixing clips

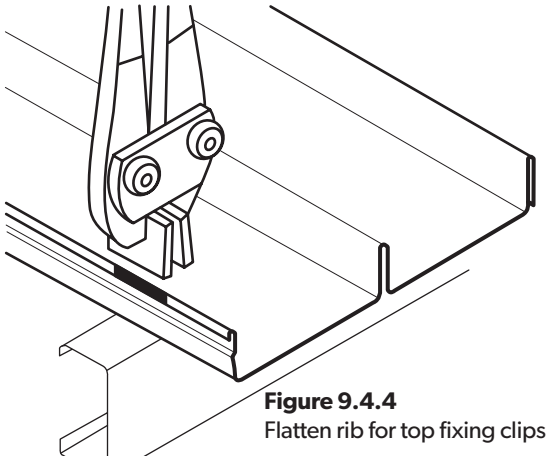


Figure 9.4.4
Flatten rib for top fixing clips

4. Fully engage the sheet with the clips, using foot pressure on the ribs over each clip. You can do this by walking along the full length of the sheet with one foot in the tray next to the overlapping rib and the other foot applying pressure to the top of the interlocking ribs at regular intervals.

Check alignment periodically

Check that sheets are still parallel with the first sheet.

Place the last sheet

Assess how the last sheet will fit in relation to the fascia.

Fix a cut starting/finishing clip to the purlins.

Place the last sheet over the finishing clips, and bend the tab of all clips over the rib. (Similar to the steps used in the first sheet. Figures 9.4.2 & 9.4.3)

Lock all ribs

All lapped ribs must be locked along their length, by button-punching at the clips, and if necessary between the clips (typically at 900mm centre to centre. Figure 9.4.6). Punching to a string line guide stretched across the sheeting is recommended as random punching mars the appearance of the finished work.

You must button-punch through the hole in each top fixing clip – you locate the clip with the pen mark made previously. When operating the punching tool, stand on the pan of the overlapping sheet to ensure that the sheets are fully engaged.

Contact your nearest Service Centre for advice on button-punching.

Ends of sheets

Wind can drive water uphill under the flashings or cappings. At the low end of a roof, wind or capillary action can cause water to run back up the underside of sheeting. To reduce these problems, turn the pans up at the top of sheets, and turn them down at the bottom using a turn-up/turn-down tool.

Turning-up

Flush turn-ups are usually used on LONGLINE 305. Cut off a portion of the female rib for at least 50mm. For a flush turn-up, you also need to cut the crown of the centre rib for at least 50mm.

Holding the end of the tool against the end of the sheet, pull the handle up 90°. If turning-up flush, fold the protruding ears flush against the turn-up tool with a rubber mallet (Figure 9.4.7).

Turning-down

All roofing on slopes below 1 in 5 (10°) must be turned-down (also called lipped).

Turning-down is usually done after the sheeting is fixed on the roof, provided there is no obstruction to the operation of the turn-down tool.

- Push the turn-down tool over the end of the tray, as far as it will go.
- Hold the tool hard against the end of the tray and push the handle to form a turn-down of about 20 degrees (Figure 9.4.8).

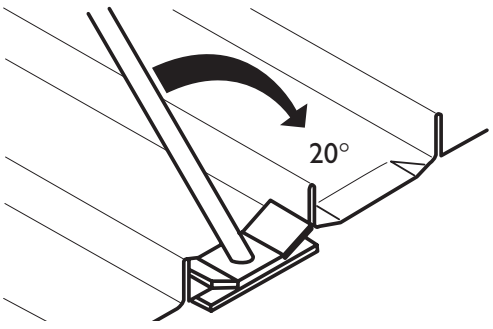


Figure 9.4.8
LONGLINE turn-down procedure

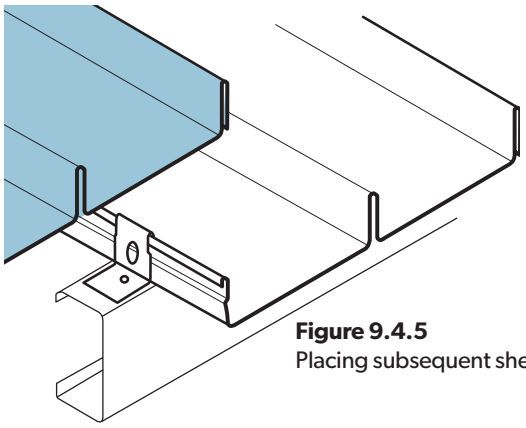


Figure 9.4.5
Placing subsequent sheets

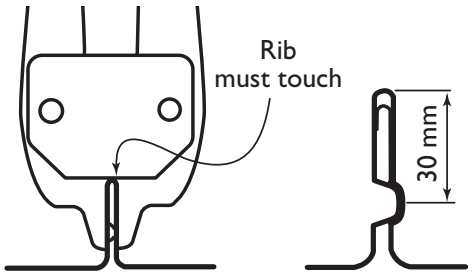


Figure 9.4.6
Lock all ribs with button punch

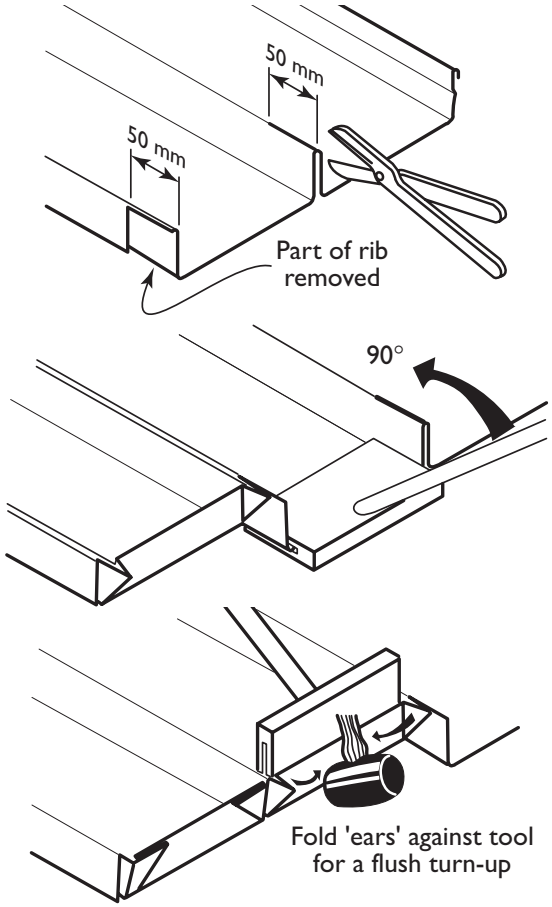


Figure 9.4.7
LONGLINE turn-up procedure

End-lapping

LONGLINE is available in very long lengths and thus end-lapping of sheets is not commonly needed. However if sheets need to be end-lapped then the under-sheet ribs have to be slightly squashed at the lap, and for the length of the lap, to allow the over-sheet to nest snugly. The rib closing tool may be suitable to squash the ribs.

Alternative Start/Finish with SHEERLINE gutter as fascia

The following installation is an alternative approach used on some commercial and residential roofs.

Preparation

Before starting, check that the supports on which your sheeting will rest are in the same plane; that the pitch and overhangs conform to the minimum specifications.

Two types of clips are used in the concealed fastening of LONGLINE 305. A starting/finishing clip (Figure 9.4.9) used to fasten the first and last sheets in a roof area and a top fastener clip.

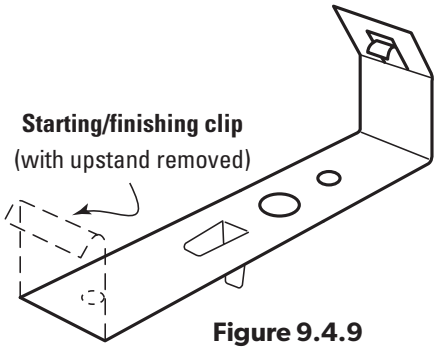


Figure 9.4.9

Installation

Consider which end of the building is best to start from.

1 Lay and fix wire mesh to the supports in accordance with the appropriate building requirements.

2 Place the glass wool insulation.

3 Position the starting/finishing clips on each support by placing onto the support nearest the gutter.

4 Where SHEERLINE gutter is to be fitted as a longitudinal fascia the turned down tab under the starting/finishing clip is used to position the overhang of the clips. On timber purlins a nail is driven through the hole in the tab into the purlins. (Figure 9.4.9)

5 Position the first sheet by locating the female rib under the tab on the upstand of the starting/finishing clips after locating the sheet longitudinally for gutter overhang etc. Then secure the sheet by folding the pre-bent clip upstands down over the female rib. (Figure 9.4.10)
If the tray turn-up at the high end of the sheeting is to be flush-stop ended, this should be done before positioning the sheets and allow an extra 50mm on the sheet length.

6 Where SHEERLINE gutter is to be fitted as a longitudinal fascia the tab under the starting/finishing clip is used to determine the clip overhang. The pre-bent upper half of the clip upstand is then folded down over the male rib after the last sheet has been positioned.

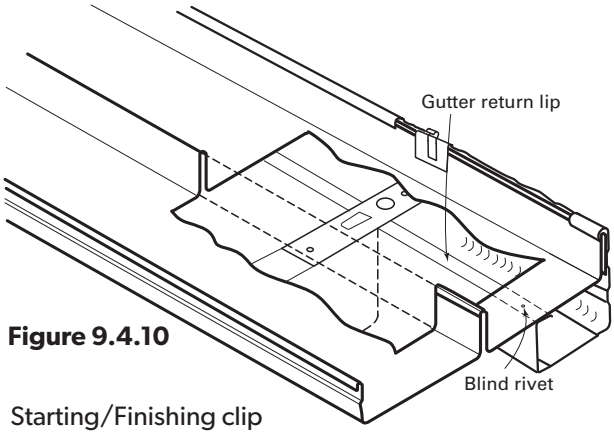


Figure 9.4.10

Starting/Finishing clip used a shown at start of roof when gutter required as fascia (use a blind rivet or wafer head screw to fasten the return leg of the SHEERLINE gutter.

Note:

As an alternative, a Starting/Finishing clip may be used. The rib can be crushed using the rib closing tool.

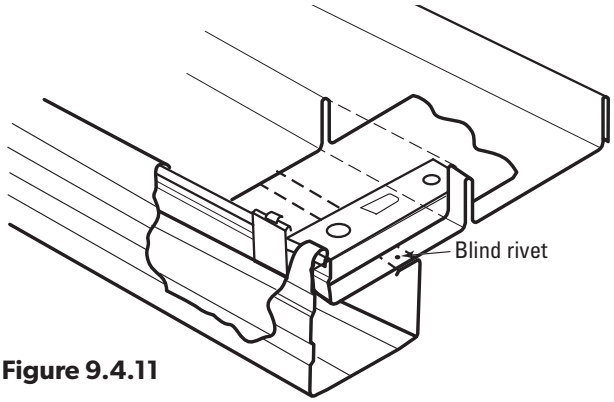


Figure 9.4.11

Starting/Finishing clip used as shown at finish of roof when gutter required as fascia.

9.5 Installing LONGLINE 305 walls

In walling applications, horizontal pressure will need to be applied locally to the sheets to engage the ribs. Use body pressure (torso, hand or foot) or use a rubber mallet if required. Care should be exercised due to the potential instability of the temporary worker access equipment.

To prevent LONGLINE 305 from sliding downward in the fixing clips, you should pierce-fix through each sheet under the flashing or capping, along the top of the sheets.

10 Ends of sheets

This chapter describes how you can treat the ends of sheets to maximise waterproofing, or to stop vermin entering.

10.1 Turn-ups

At the high end of roofing, wind can drive water uphill, under the flashing or capping, into a building. To minimise this problem, you turn up the valleys (or pans) at the high end of roofing. (The process is called turning-up (or stop-ending).

All roofing on slopes below 1 in 2 (25°) should be turned-up.

Turn-up tools are available for all our roofing profiles except CUSTOM ORB and LONGLINE 305 when it is tapered (Figure 10.1.1 on the next page).

During the turn-up operation, care should be exercised to prevent tearing or puncturing the steel sheets.

You can turn-up sheets before or after they are fixed on the roof. If you do the latter, you must have sufficient clearance for the turn-up tool at the top end of the sheets (about 50mm).

Turning-up CUSTOM ORB

With pliers, multi-grips or a shifting spanner closed down to approximately 2mm, grip the valley corrugations 20mm in from the end of the sheet and turn up as far as possible (Figure 10.1.2). Be careful not to tear the sheet.

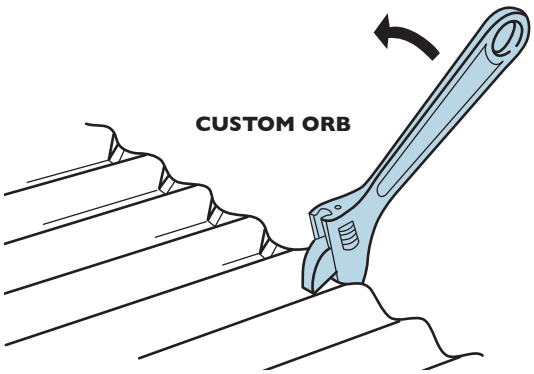


Figure 10.1.2
Turning-up CUSTOM ORB

Turning-up TRIMDEK and SPANDEK

Slide the turn-up tool onto the end of the sheet as far as it will go. Holding the tool against the end of the sheet, pull the handle to turn up the tray about 80° (Figure 10.1.3).

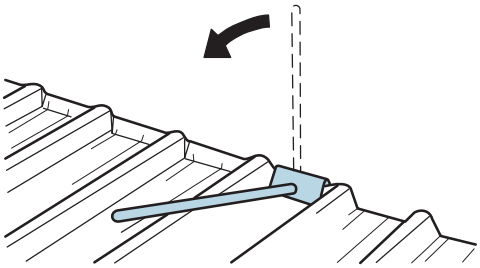


Figure 10.1.3
Turning-up (TRIMDEK shown)

Turning-up KLIP-LOK

You get the best results by first cutting off the corner of the down-pointing leg of each female rib. Do this before you place the sheets on the roof.

- With the hinged turn-up tool open: position the tool on the sheet with the locating pins hard against the end of the sheet.
- Hold the handles together to clamp the tool onto the tray, and pull them to turn-up the tray 90° (Figure 10.1.4).

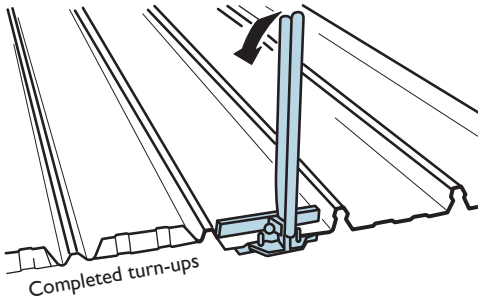


Figure 10.1.4
KLIP-LOK tool ready for turn-up

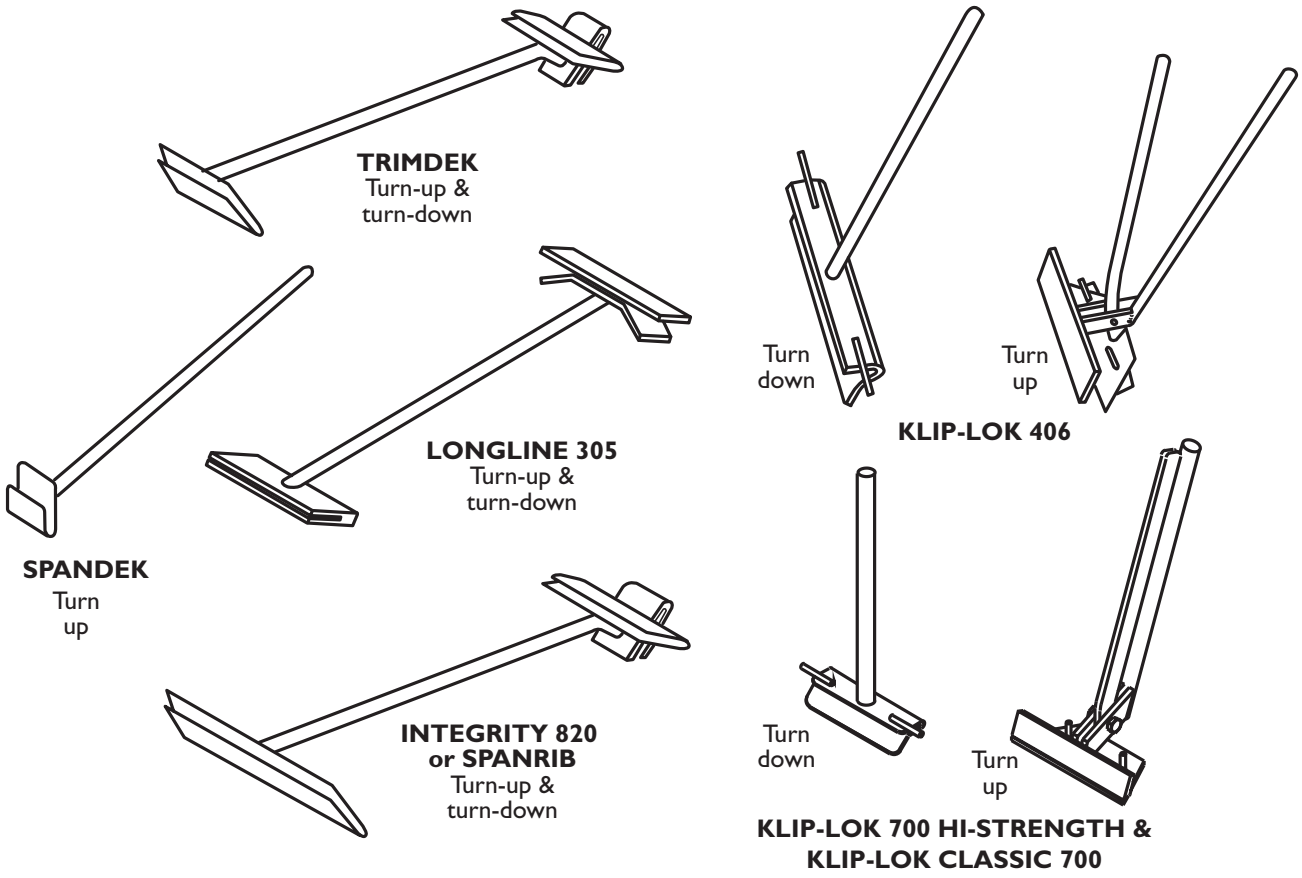


Figure 10.1.1
Turn-up and turn-down tools

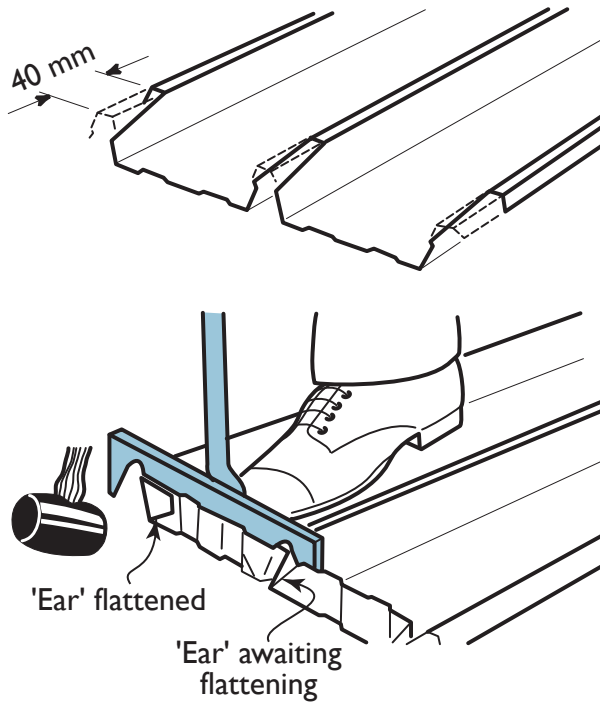


Figure 10.1.5
Using the backing tool for flush turn-up on KLIP-LOK (G300 steel shown)

Flush turning-up KLIP-LOK 406

In normal turning-up of KLIP-LOK, the tops of the ribs protrude past the turned up tray. Consequently the turn-ups cannot be positioned hard against a fascia or wall, or the ends of the sheets on either side of the ridge cannot be butted together. This is usually of no consequence because the turn-up is completely covered by a flashing or capping. However, if you want the ribs not to protrude past the turn-up, you can make a flush turn-up. You need an extra 40mm in sheet length for flush turn-ups.

1. Cut the top of each rib before turning-up the pans (Figure 10.1.5). Turn-up the pans as described before.
2. Position the backing tool (if available) in the tray and hold it hard against the turn-up with a foot.
3. With a rubber mallet, fold the protruding 'ears' flush against the backing tool.

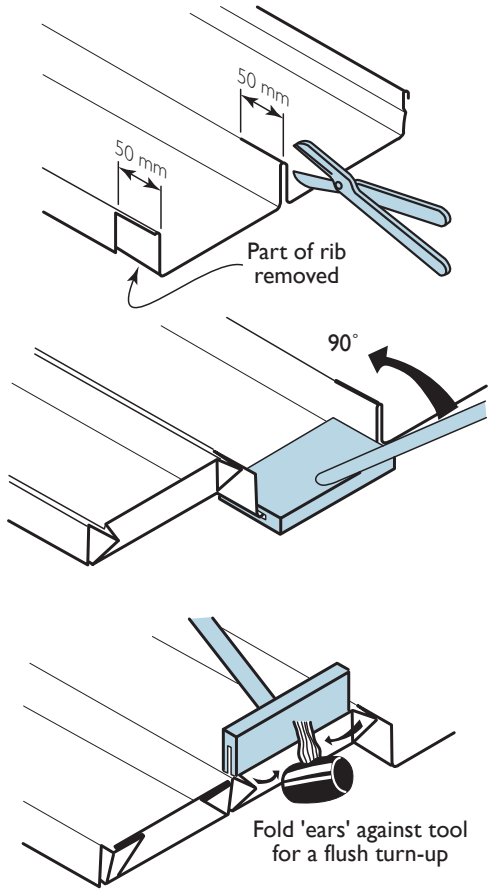


Figure 10.1.6
Turning up LONGLINE 305

Turning-up LONGLINE 305

Flush turn-ups are usually used on LONGLINE 305. Cut off a portion of the female rib for at least 50mm. For a flush turn-up, you also need to cut the crown of the centre rib for at least 50mm.

Holding the end of the tool against the end of the sheet, pull the handle up 90°. If turning-up flush, fold the protruding 'ears' flush against the turn-up tool with a rubber mallet (Figure 10.1.6).

You need an extra 50mm in sheet length for flush turn-ups.

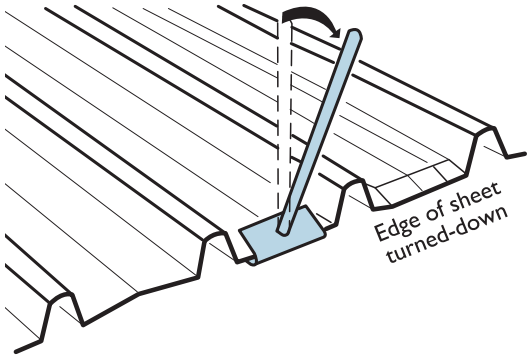


Figure 10.2.1
Turning-down the gutter end
(TRIMDEK shown)

10.2 Turning-down

When wide tray sheeting is used on roof slopes below 1 in 5 (10º) the end of the trays at the low end of the sheeting should be turned down slightly with a turn-down tool. At the low end of roofing, wind or capillary action can cause water to run back up the underside of the flat trays of the sheeting. The process is called turning-down (or lipping). Turn-down tools are available for TRIMDEK, KLIP-LOK 406, KLIP-LOK 700 HI-STRENGTH, LONGLINE 305, INTEGRITY 820 and SPANRIB.

During the turn-down operation, care should be exercised to prevent tearing or puncturing the steel sheets.

Turning-down is usually done after the sheeting is fixed on the roof, provided there is no obstruction to the operation of the turn-down tool.

- Push the turn-down tool over the end of the tray, as far as it will go.
- Hold the tool hard against the end of the tray and push the handle to form a turn-down about 20°.

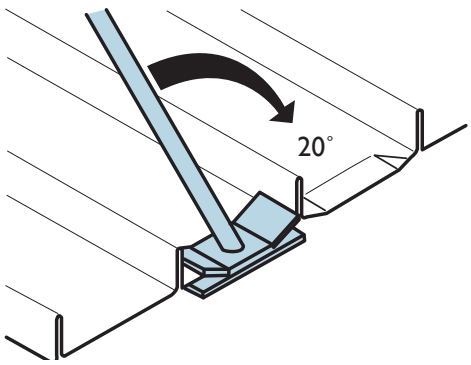


Figure 10.2.2
Turning-down the gutter end
(LONGLINE 305 shown)

Sheet-ends on low slopes and overlaps

For claddings laid on slopes of 5 degrees or less, the underlap lip of the under-sheet may require to be cut back on the corner at the downhill end of the sheet, to block capillary action (Figure 10.2.3).

This may be required where the return lip of the underlapping sheet nests snugly with the overlapping sheet without a gap, or where there is interference with the down-turning of the valley.

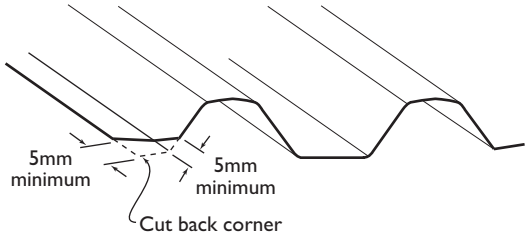


Figure 10.2.3
Cut SPANDEK on low slopes.

10.3 Blocking off rib cavities

Dust, insects, birds, rodents and wind-driven rain can enter a building through the cavities under ribs. To minimise these problems the cavities can be blocked off. The blocking off could be achieved by the use of infill strips or, where available, by rib stop-ends. In some regions, the rib stop-ends for KLIP-LOK 406 may be available.

Fitting KLIP-LOK 406 rib end-stops during sheet installation

Fix the rib end-stops to the side of the eaves support after the KLIP-LOK clip has been secured in position. Align the rib end-stops with the upstands of the fixing clips (Figure 10.3.1).

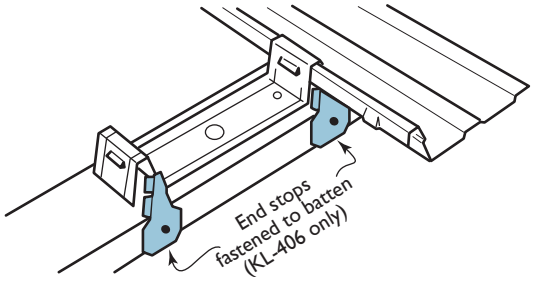


Figure 10.3.1
Fitting rib end-stops during installation of sheets

Fitting KLIP-LOK 406 rib end-stops after sheet installation

Bend the flat of the end-stops 90°. Push an end-stop into the space under each rib until the flat is wedged firmly between the underside of the cladding and support (Figure 10.3.2).

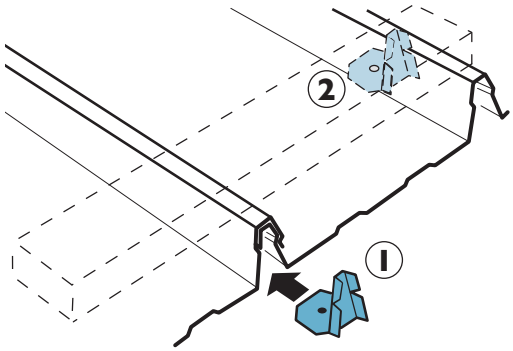


Figure 10.3.2
Fitting rib end-stops to KLIP-LOK 406 after installation of sheets

Infill strips

Closed-cell, foam-plastic infill strips are available to match the top or bottom profile of our roof claddings.

At the lower end of cladding, the strip is sandwiched under the roof cladding. Similarly, at the upper end, the strip is sandwiched between topside of the roofing and the underside of the flashing or capping (Figure 10.3.3).

Don't use infill strips that can absorb water because retained moisture can lead to deterioration of the sheet coating. Avoid using infill strips made from, or treated with, flammable materials, particularly in areas prone to bushfire (Section 11.8).

Where roof pitches are below 1 in 5 (10°), you should incorporate infill strips to maximise resistance to water entry.

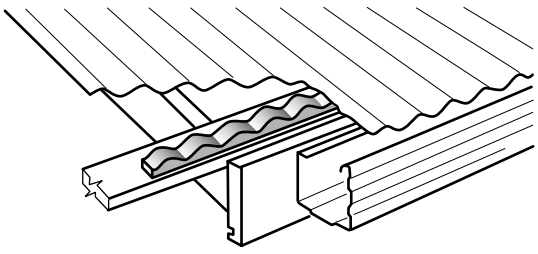


Figure 10.3.3
Profiled closed-cell infill at eaves

10.4 End-lapping

Because our roofing and walling is manufactured by continuous processes, sheet lengths can be supplied up to the limits of transport regulations which are frequently long enough to cover roofs without end-lapping the sheets.

If you contemplate using sheets that are shorter than the full span, and end-lap them, you need to consider:

- the roof slope, because it affects the amount of end-lap (see Table 10.4.1);
- the method of fixing of the cladding to its supports, because it affects the maximum length of sheet (see Section 10.5 - Expansion joints and Table 10.5.2).
- Treat purlin spacings at laps and expansion joints as End Spans.

Table 10.4.1
End-laps

	End-lap minimum (mm)	End-lap maximum (mm)
Roof slope Less than 1 in 4 (15°)	200	300
Greater than 1 in 4 (15°)	150	250
Walls	100	200

Fixing methods for end laps

• Pierce-fixed sheets:

Position the lap centrally over the support; and the fastening secures both the lap and the cladding. For roofing (Figure 10.4.1a) position the crest fasteners as detailed in Table 3.8.1, and for walling (Figure 10.4.1b) position the valley/pan fasteners as detailed in Table 3.8.1. For cladding with two fastener patterns, use the pattern with the greater number of fasteners (e.g. for CUSTOM ORB use 5 fasteners/sheet/support pattern)

• Concealed-fixed sheets:

The lap should be positioned just clear, and on the high side of the support (Figure 10.4.1c). This will allow normal concealed fastening at the support and thus allow thermal movement to occur at the clip. The lap is secured with pierce fasteners through the pan/valley. For alternative lapping of concealed-fixed cladding, by fixing through the valley/pan directly into the support (similarly to that detailed for walling above) please contact your nearest Lysaght service centre for advice.

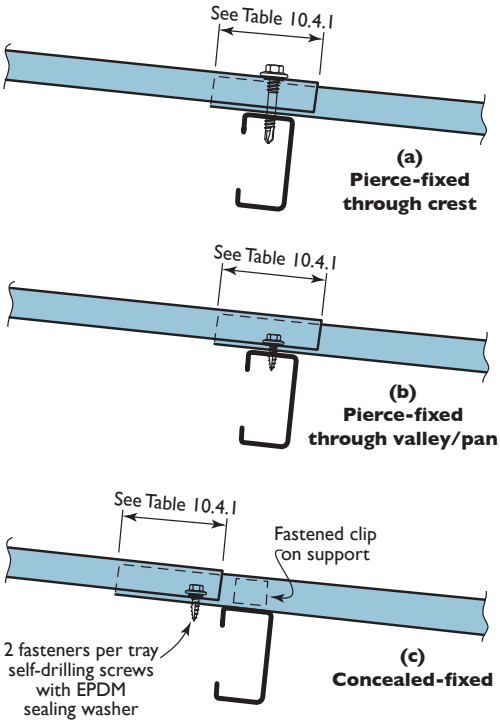


Figure 10.4.1
Fixing at end laps

To make the end-lapping of KLIP-LOK 406 easier: remove, for the length of the lap, the down-turn of the underlapping ribs of the upper and lower sheets in each sheet run (Figure 10.4.2). The cut-back ribs are covered by the sheets of the next sheet run and provide an added stitch screw through the side of the ribs.

For LONGLINE end-lapping the undersheet (lower sheet) ribs will have to be slightly squashed at the lap and for the length of the lap to allow the oversheet (upper sheet) to nest snugly. The rib closing tool may be suitable to squash the ribs. To make end-lapping easier, remove the down-turn of the under-lapping rib of the lower sheets for the length of the lap.

KLIP-LOK 700HS & KLIP-LOK CLASSIC are not recommended to be end- lapped. Instead, an expansion joint must be used. (Refer to Section 10.5 below.) Ideally long length sheets from a mobile rollformer should be used where possible (KL-700HS) as this eliminates the need for end-lapping.

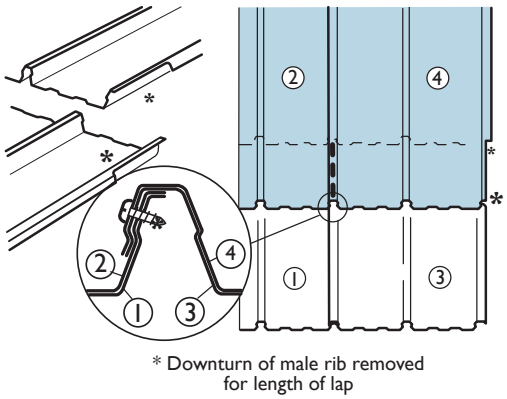


Figure 10.4.2
Remove down-turn of male rib when end-lapping KLIP-LOK 406

Order of laying

For profiles other than LONGLINE 305, lay each run of sheets in turn from lower to upper before moving on to the next run. For LONGLINE 305, lay all lower run of sheets first, then lay the upper sheets (Figure 10.4.3).

Spacing of supports at end-laps

For the maximum spacing between purlins, either side of an end lap in a roof, use the spacing given for end spans (terminology and spacing in Table 2.13.1).

End laps in pitches less than 15 degrees

End laps in roofs of less than 1 in 4 (15°) slope should be sealed with a sealant.

Use two runs of sealant (Figure 10.4.4):

- one run of sealant at the low end of the lap (to prevent moisture being drawn in by capillary action);
- the other run at the high end (to prevent condensation from running down the underside of the top sheet and entering the lap).

When the sheets are lapped together and fixed, the compressed sealant should just appear at the end of the lap.

1. With the top sheet upside down, extrude a 3mm bead of sealant across the underside of this sheet about 25mm from the end.
2. Position the bottom sheet, then extrude a 3mm bead of sealant across the top of the sheet to encapsulate the cut end of the underlapping sheet.
3. Turn the top sheet over and fit it in place.

The side-lap between sheets of roofing has a cavity to prevent capillary action between adjacent sheet runs (Section 8.2).

It is important that excess sealant extruded from an end-lap does not enter this cavity because, if it does, moisture that may have entered the side lap will not be able to drain unimpeded down the roof slope.

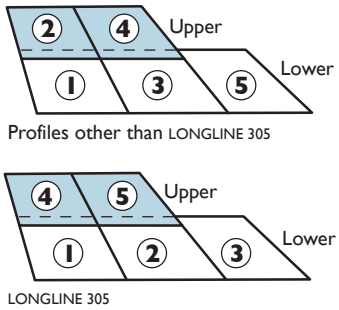


Figure 10.4.3
Laying sequence for end-lapped sheets

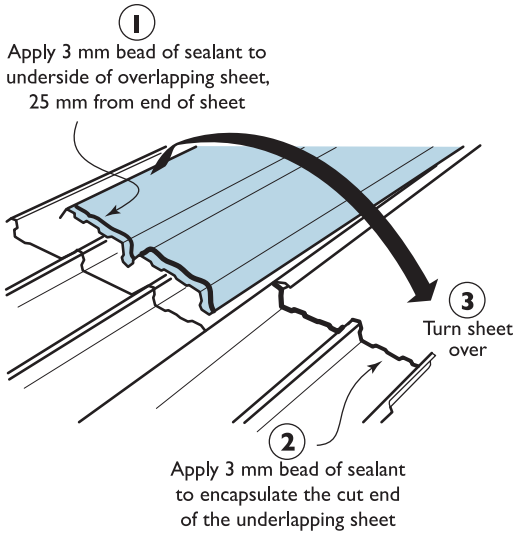


Figure 10.4.4
Sealing end-laps on very low pitched roofs

Table 10.5.1
Thermal expansion and contraction of steel cladding

Sheet length (mm)	Expansion or contraction (mm)		
	10 C° change	50 C° change	75 C° change
5000	0.6	3	4.5
10000	1.2	6	9
15000	1.8	9	13.5
20000	2.4	12	18
25000	3.0	15	22.5
30000	3.6	18	27

Table 10.5.2
Maximum distance between top & bottom rows of fasteners on a sheet, before expansion joint is needed

Fixing system	Maximum distance between top and bottom rows of fasteners (m)
Pierce-fixed through crests	24
Walling pierce-fixed in valleys/pans	15

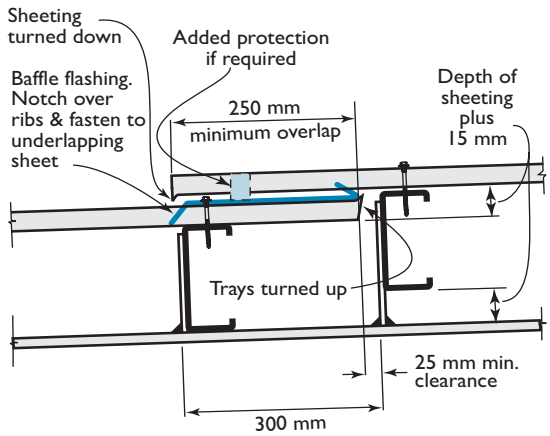
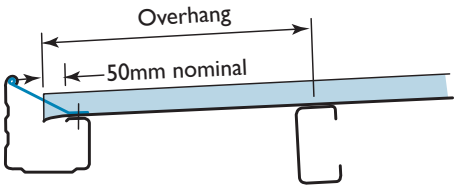
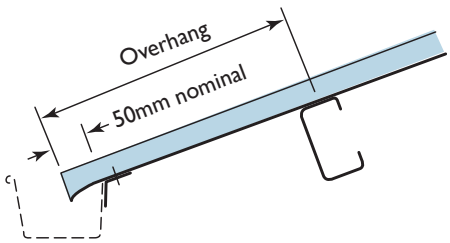


Figure 10.5.1
Expansion joint detail



SHEERLINE GUTTER fixed to underside of roofing (200 mm centres)



Galvanised or ZINCALUME®
steel angle 50x50x1.2mm
fixed to underside of roofing
(200mm centres).
Gutter may be fixed to angle.

Figure 10.6.1
Methods of stiffening roof overhangs

10.5 Expansion

Background on thermal expansion

All metals expand and contract with changes in temperature. Although steel is by far the least affected of all the metals commonly used for roof and wall cladding, the changes in length experienced in very long runs of roofing are significant.

On a clear hot summer day, with no wind, the steel temperature in roof cladding can reach approximately 50°C in COLORBOND® SURFMIST®, 60°C in plain ZINCALUME® and more than 80°C in COLORBOND® NIGHT SKY®.

Examples of the thermal changes in lengths of steel cladding that would result from various temperature changes in the steel are shown in Table 10.5.1.

The actual expansion or contraction between the end of a sheet and the last support would only be a fraction of the figures shown because the movement in the length of fixed cladding would normally take place from the centre towards each end of the sheet. The movement at each end is thus only half the total expansion or contraction.

Transverse thermal expansion poses no problems in ribbed cladding because each rib absorbs some transverse movement.

Expansion joints

Thermal expansion effects are mitigated by slight bending of fastener shanks, thermal movement of the building structure, and slight flexing of the purlins (where they are not restrained by cleats or bridging). However, for very long runs of roofing, you should include an expansion joint to overcome linear thermal expansion.

Table 10.5.2 shows the maximum distance between the top and bottom rows of fasteners on a pierce-fixed sheet. For LONGLINE in distances of greater than 35m, please contact your Service Centre for advice. If the total length of two sheets pierce-fixed through the lap, or a single sheet exceeds this distance, then an expansion joint is needed. There should be no more than one pierce-fixed end-lap between expansion joints.

An expansion joint involves overlapping the ends of the upper sheets over the ends of the lower sheets—but with a clearance between them (about 15mm). A typical overlap is 250mm (this overlap is not the same as the overhang in Table 2.13.1 which does not apply to expansion joints). The clearance is usually created by having all the purlins for the roofing on the high side of the joint, higher than the roofing on the low side of the joint. An extra purlin is needed at the joint. A baffle flashing provides weatherproofing. See Figure 10.5.1.

Where there is a risk of high winds, or the ribs result in a large opening, you may need protection, such as extra flashing or the inclusion of closed-cell foam infill strips.

10.6 Roof overhang with edge stiffener

For the stiffened overhangs listed in Table 2.13.1, you need to stiffen the gutter ends of the roofing.

Our SHEERLINE gutter, fixed through the return lip to the underside of roofing at 200mm centres will provide the required stiffening.

Alternatively, you can use a 50 x 50 x 1.2mm galvanised/ ZINCALUME® steel angle fixed at 200mm centres to the underside of the roofing about 50mm from the end.

11 Flashings

Flashings and cappings are strips of metal formed to weatherproof the edges of roofing and walling. For the purposes of this chapter, only the term flashing is used. The following sections should be considered as a guide only.

For a comprehensive account of flashing guidelines, refer to HB39-1997 and acceptable trade practices. Our Lysaght publication 'Architectural Detailing Guide' which is available at www.lysaght.com provides more guidelines.

Similar methods of flashing are used for different cladding-profiles. You can adapt the principles to suit your application.

In all cases it is important to have ample cover provided by the flashing and proper turn-up of the cladding underneath.

Be careful when moving between supports. Do not walk in the pan immediately adjacent to flashings or translucent sheeting. Walk at least one pan away.

Lysaght has a range of standard flashings. We can also supply custom flashings to your requirements – ask your local service centre for details.

11.1 Materials

It is very important that flashings be made from materials that are compatible with the cladding (Section 2.10).

Lead flashing is not recommended, however it will usually be retained when re-roofing, because it is usually cemented into the structure. In these cases:

- the top surface of the lead flashing must be painted with a good quality exterior paint system (to limit contamination with lead compounds in water running off the flashing); and
- there must be a barrier between the lead flashing and the cladding: either a plastic strip (such as polythene dampcourse), or paint.

Flashings should conform to AS/NZS 2179.1:1994, and be compatible with the cladding (Section 2.10).

Materials for flashings are available in ZINCALUME® or COLORBOND® finishes.

11.2 Longitudinal flashings

Longitudinal flashings run parallel to the pans or valleys, and are made to suit the cladding profile (Figure 11.2.1). They should have an edge turned-down to dip into the pan or valley.

Flashing Cover

The minimum recommended cover of longitudinal flashings over cladding should be as follows: (as taken from HB39-1997)

Pierce fixed roof sheet	150mm min.
Concealed fixed roof sheet	Into full pan (2/3 pan covered)

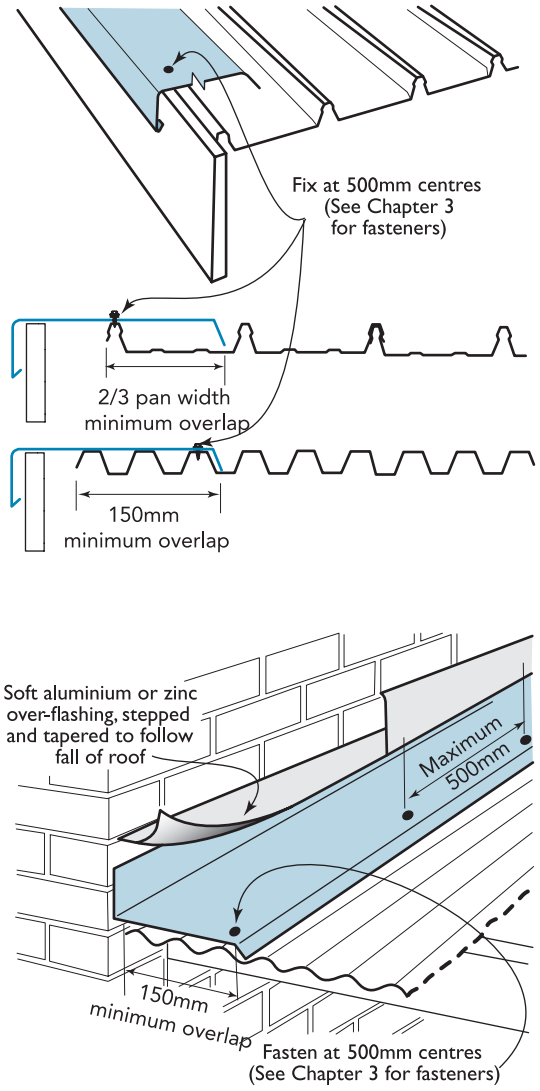


Figure 11.2.1
Typical longitudinal flashings

11.3 Transverse flashings

Transverse flashings run across the pans or valleys (Figure 11.3.1). They usually have a stiffening lip, along the lower edge, which is turned-down to dip into the pan or valley. To maximise weatherproofing, the bent lip is commonly fashioned (such as notching or scribing) to fit the profile.

Fashioning is preferred for low-slope roofs and/or where exposed to high wind..

The turn-down for transverse flashings for wide panned cladding is always notched or scribed to fit over the ribs.

For CUSTOM ORB or CUSTOM BLUE ORB the turn down for transverse flashing can also be fashioned by lightly pressing into the valleys, however this depends upon the type of method used for the flashing. For steep-sloped roofs where the roll-top ridge style is used the the fashioning is not done.

Flashing Cover

Lysaght produces a range of standard flashings (hip, barge, apron). To increase weathertightness, Lysaght recommends you maximise the overlap between flashings and claddings.

Fixing of Flashings

Longitudinal flashings shall be fastened at maximum 500mm centres. Transverse flashings shall be fastened in accordance with HB39-1997, as detailed below.

Profile (min.)	Recommended Fixing Spacing
CUSTOM ORB/CUSTOM BLUE ORB	Every 4th rib
INTEGRITY 820	Every rib
KLIP-LOK 406	Every rib
KLIP-LOK 700 HIGH STRENGTH	Every rib
KLIP-LOK CLASSIC 700	Every rib
LONGLINE 305	Every rib
SPANDEK	Every 3rd rib
TRIMDEK	Every rib

The above fastener spacing relates to the stitching of flashings to sheeting. It does not constitute the minimum number of fasteners required to fix the sheeting to purlins.

Notching tools

Hand-operated notching tools cut one notch at a time. Each tool matches only one cladding profile. There are two types of tool; their use depends on whether or not the edge of the flashing has first been bent down (Figure 11.3.2).

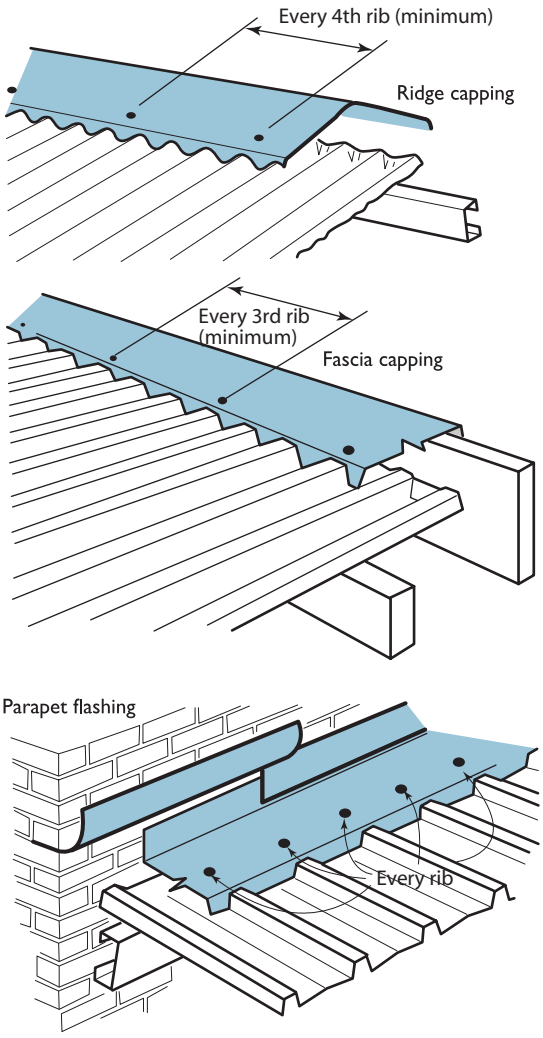


Figure 11.3.1
Typical transverse flashings

Table 11.3.1
Notching tools

Type of tool	Edge turned down before notching	Available for
Horizontal notching tools	**No**	Availablity subject to inquiry
Vertical notching tools (also called speed notchers)	**Yes**	KLIP-LOK 406 KLIP-LOK 700 HI-STRENGTH KLIP-LOK CLASSIC 700 SPANDEK, TRIMDEK Others subject to inquiry.

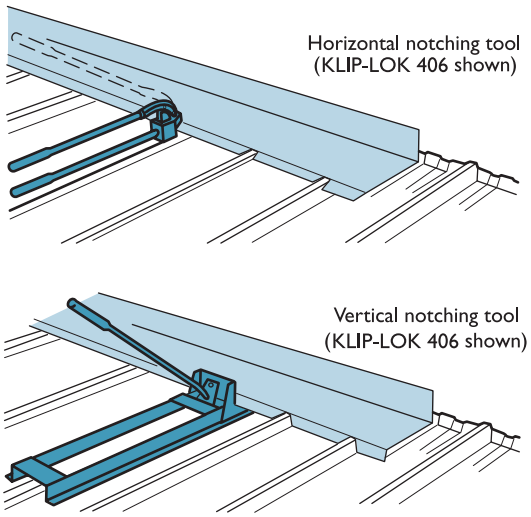


Figure 11.3.2
Using notching tools

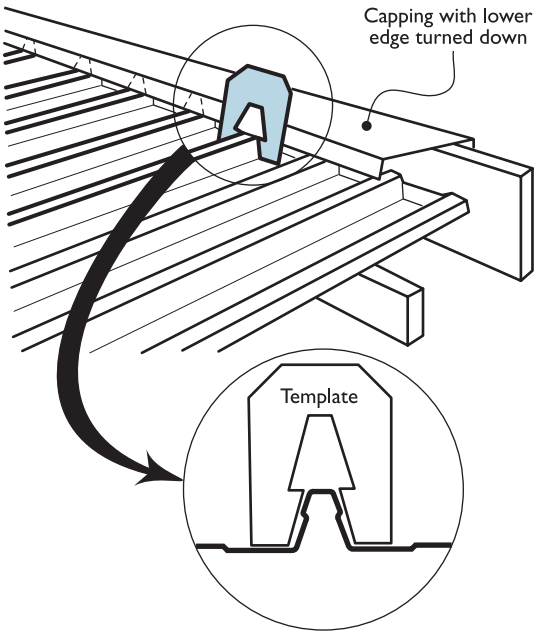


Figure 11.3.3
Using a template to mark out for notching with tinsnips

Using notching tools

After the cladding is fixed and the turn-ups finished, proceed as follows.

- Place a flashing with the notch-edge resting on the ribs.
- Locate your notching tool over a rib with the notching head against the flashing.

  VERTICAL TOOL: The body locates along the rib.

  HORIZONTAL TOOL: the lugs on the underside locates on top of the rib.
- Raise the handle to open the tool and:

  VERTICAL TOOL: lift the flashing into the mouth of the tool;

  HORIZONTAL TOOL: slide the mouth of the tool over the edge of the flashing as far as it will go.
- Push down on the handle to perform the notching.
- Repeat for all ribs, checking in each case that the flashing is correctly positioned.
- If you are using a horizontal tool, bend down the tongues between the notches over a suitable straight edge (such as a piece of timber).

Notching with tinsnips

If notching tools are not available, flashings can be notched to the rib profile with tinsnips (Figure 11.3.3). The procedure is sometimes known as scribing. After the cladding is fixed and the turn-ups finished, proceed as follows.

- Place the flashing with the turned-down edge resting on the ribs.
- Mark out the notching using a template positioned over each rib.
- Cut the notches with tinsnips.

This procedure is also used for hip cappings.

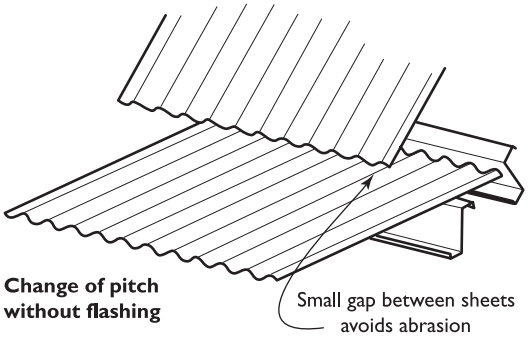
Fasteners for transverse flashings

You must properly fix both flashings and the ends of all sheets.

Where the cladding is pierce-fixed through crests, and the position of the purlin allows it, the fasteners used to fix the sheets, may also fix the flashings.

On all other installations, pierce-fix your flashing to the ribs or crests of the sheets.

11.4 Flashing at change of pitch



Joining flashings

The overlaps of transverse flashings should be sealed with a recommended sealant and fastened. Before finally positioning and fixing the lap, turn over the top piece and apply a 3mm bead of sealant across the flashing, about 12mm from the end.

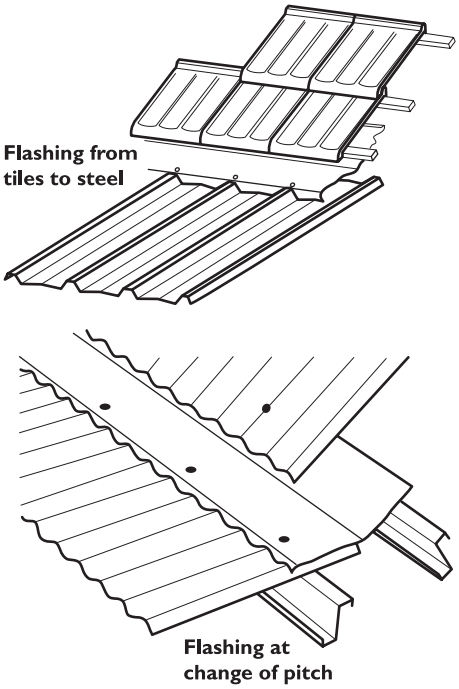


Figure 11.4.1
Typical flashing at changes of pitch

11.5 Flashing large roof penetrations

Penetrations through ribbed cladding block the valleys (or pans), and thus affect the free flow of rainwater down a roof. All flashings have to weatherproof the cladding – but on the uphill side of large penetrations, they also have to channel rainwater sideways into valleys that run unobstructed to the eaves.

Four methods are described here. In all methods the ends of cut ribs may be closed off with caps on the outside of the rib, or with plugs inside the ribs. Plugs must be used on side-laps to allow the anti-capillary cavity to drain.

Note: For masonry construction, Building Code Australia (BCA) requires the use of Damp Proof Course (DPC) to ensure weatherproofing. For acceptable methods see BCA section on weatherproofing masonry.

Support framing

Wherever one or more of the sheet ribs are cut, you must provide framing to support the cut ends of the roof cladding each side of the penetration.

Existing flashing

If you have to re-use lead flashings that are built into the structure, special protection is needed (Section 11.1).

Method 1: Head gutter and apron flashings

This is often the simplest method, and commonly used for existing protrusions (Figure 11.5.1). See also Fig.2.4.1.

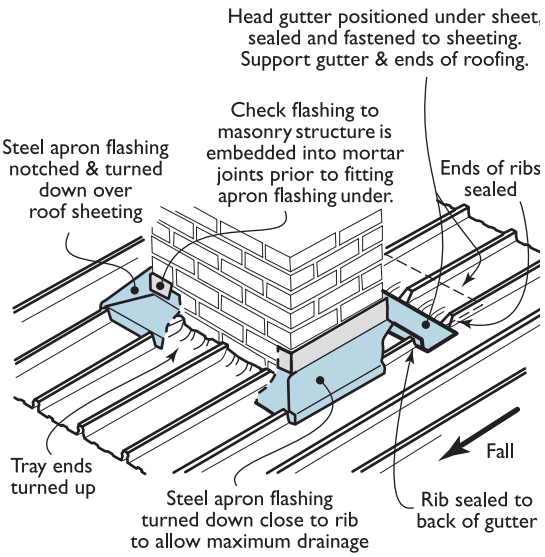
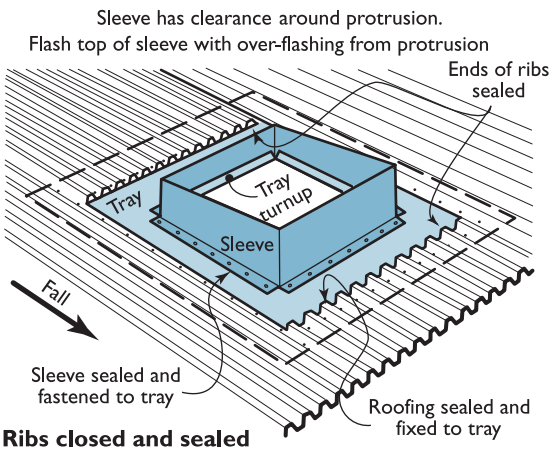
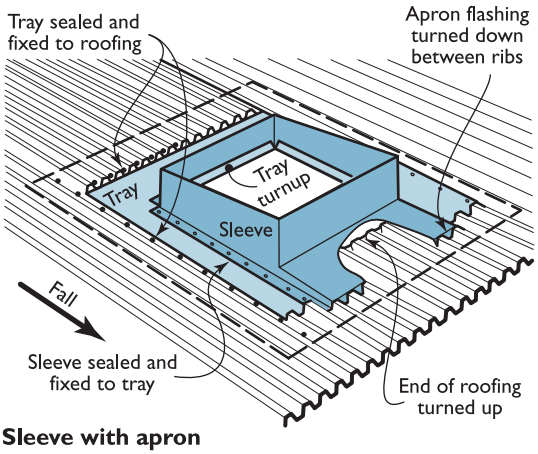


Figure 11.5.1
Flashing method 1: Head gutter



Ribs closed and sealed



Sleeve with apron

Figure 11.5.2
Flashing method 2: Flat tray and sleeve

Method 2: Flat tray and sleeve

To avoid fitting and sealing end caps to all the sheet ribs on the low side of the penetration, an apron flashing can be fitted to the sleeve and sealed to the tray each side.

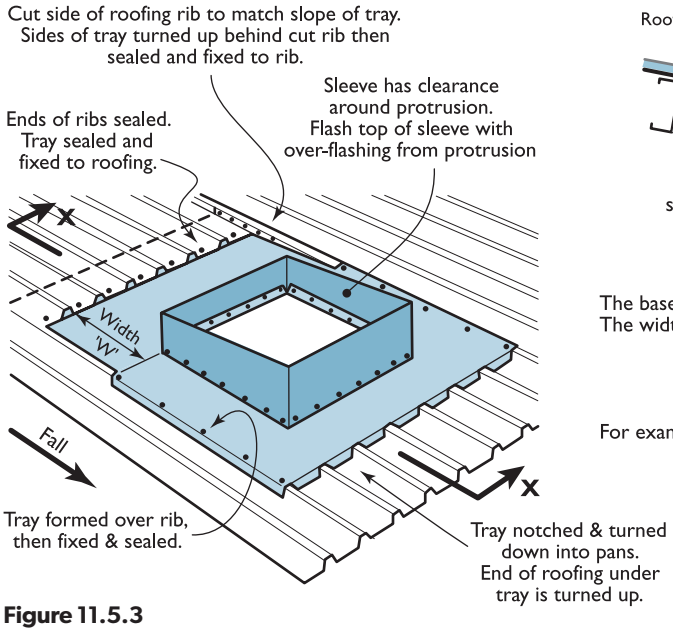
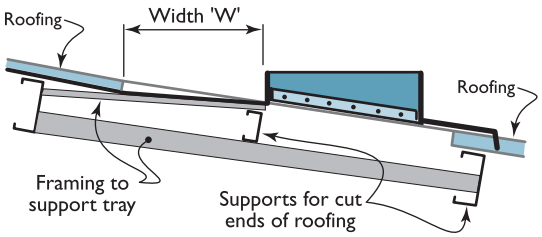


Figure 11.5.3
Flashing method 3:
Tray gutter for steeper roofs



SECTION X-X

The base of the tray over width 'W' slopes slightly towards the protrusion. The width 'W' varies with this slope, the roof pitch and the rib height. Thus:

$$W = \frac{\text{Rib height}}{\sin(\text{roof pitch} - \text{slope of tray})}$$

For example: if the tray slopes 1 in 50 (1) and the roof pitch is 1 in 12 (5).

RIB DEPTH	WIDTH 'W' (minimum)
25 mm	360 mm
29 mm	420 mm
41 mm	590 mm

Method 3: Tray gutter for steeper roofs

If the roof pitch is more than, say 1 in 12 (5°), you cut the roof cladding sufficiently high above the penetration to allow a tray gutter to raise rainwater over the top of the sheet ribs and divert it around the penetration (Figure 11.5.3).

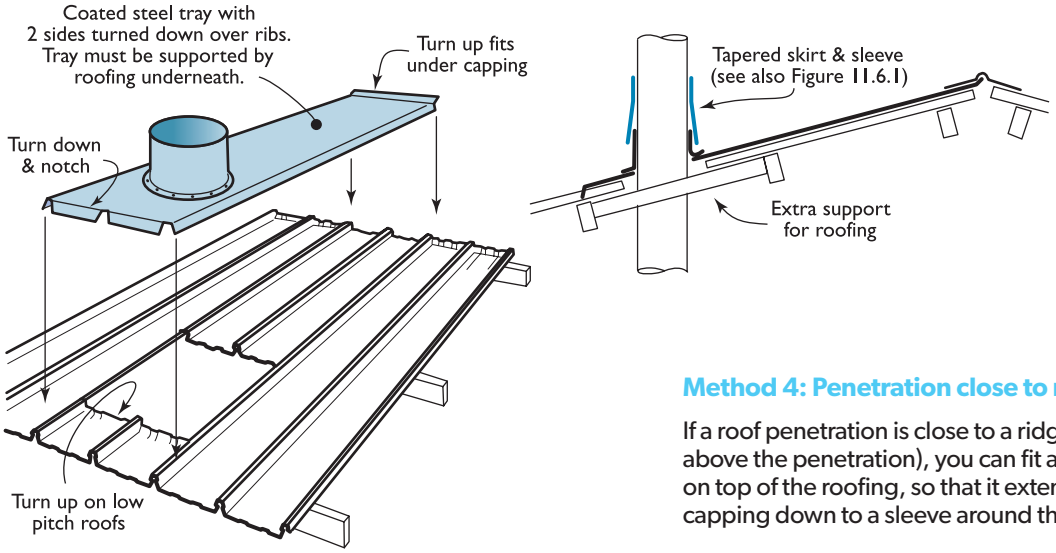


Figure 11.5.4
Flashing method 4: Penetrations close to ridge capping

Method 4: Penetration close to ridge capping

If a roof penetration is close to a ridge capping (or flashing above the penetration), you can fit a simple flat tray, on top of the roofing, so that it extends from under the capping down to a sleeve around the penetration.

11.6 Flashing small roof penetrations

A flanged cylindrical sleeve is a fairly simple method of flashing around small penetrations (such as pipe penetrations) which fit between the ribs of a roof sheet, or penetrate only a single rib.

Two methods are described here. Wherever roofing is cut, you must consider providing extra support for the roofing above and below the penetration. Where one or more of the sheet ribs are cut, you must provide framing to support at the cut ends of the roof cladding each side of the penetration.

Method 1: Tapered metal skirt and sleeve

This method uses parts custom-fabricated from metal. There is no positive seal between inside the building and the outside atmosphere (Figure 11.6.1).

Method 2: Sleeve

This is often the simplest method (Figure 11.6.2). Flexible flanged sleeves can be bought for flashing around penetrations of at least 350mm diameter. They overcome the problem of capping and sealing the open ends of cut ribs. A sleeve is commonly used, though silicone sealant has a wider operating temperature range and is available in a wider range of colours.

The flange around the base of the sleeve can be contoured by hand to match the cladding profile before it is sealed and fixed to the cladding.

Be careful not to dam any valleys or pans so that rainwater can drain freely from the high side of the roof penetration. Moisture held in such areas can cause deterioration of the sheet coating, reduced life expectancy or poor appearance.

Where damming of any valley or tray is unavoidable, due to the size of the pipe penetration, treat the installation as a large penetration (Section 11.5).

Copper penetrations

All copper pipe penetrations through ZINCALUME® or COLORBOND® steel cladding must be physically and electrically isolated from the cladding. This can be done by using a sleeve of PVC polythene or similar plastic that is also ultra-violet stable.

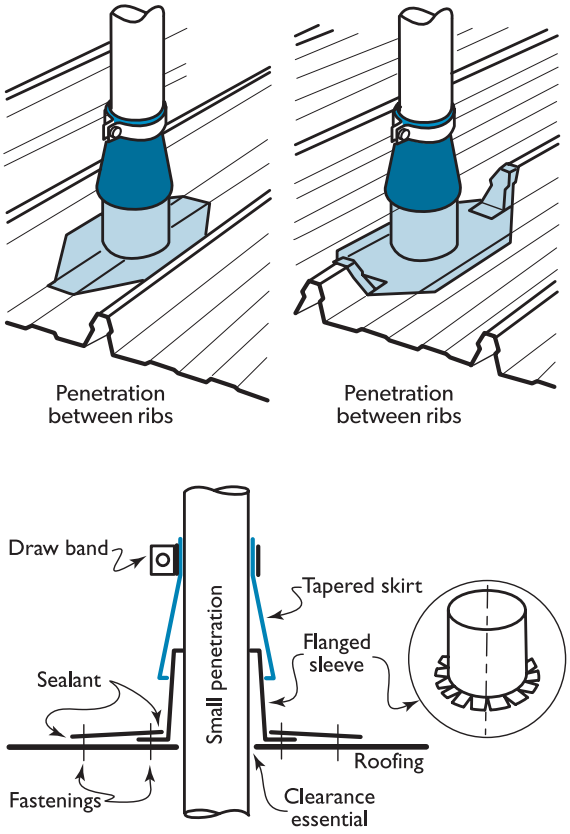


Figure 11.6.1
Small penetration with metal skirt and sleeve

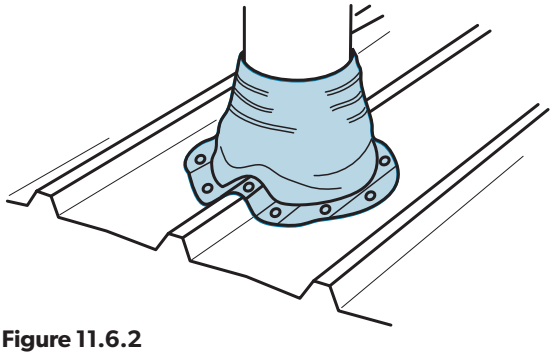


Figure 11.6.2
Small penetration with sleeve (Dektite® sleeve illustrated)

11.7 Flashing walls

Cladding is usually installed with the profile running vertically or horizontally, though sheets have been laid diagonally—the choice is aesthetic.

Wind can drive rain hard against wall flashings, so it is important that you pay attention to the detailing of flashings around windows, doors, re-entrant and external corners, to ensure you get a watertight building. You also want a neat appearance.

We make wall flashings for some wall claddings (like EASYCLAD and MINI ORB) which are sometimes called trims. Where these are not suitable, custom-made flashings can be easily produced following the general principles described in this section.

Walling profile running horizontally

- It is usual to lay the first sheet at the bottom of a wall and work upwards towards the eaves. You want the window and door flashings to fit properly into the valleys, so you should locate the first sheet relative to the heads and sills of doors and windows. Thus, you first have to decide where the cladding will eventually be located at the heads of doorways and at the heads and sills of windows before you place the first sheet.
- Where possible, select the vertical size of windows so that the flashings at both heads and sills will coincide neatly with the pitch of your profile (Figure 11.7.1).
- Be sure that the crests of the profile align with each other on adjacent walls, either side of a corner—this ensures that horizontal flashings fit properly into all valleys.
- Where valleys create a void at flashings, use closed-cell foam plastic infill (Figure 10.3.3).
- Where wind-driven rain can be expected, turn back the edges of flashing to restrict water movement past the flashing.

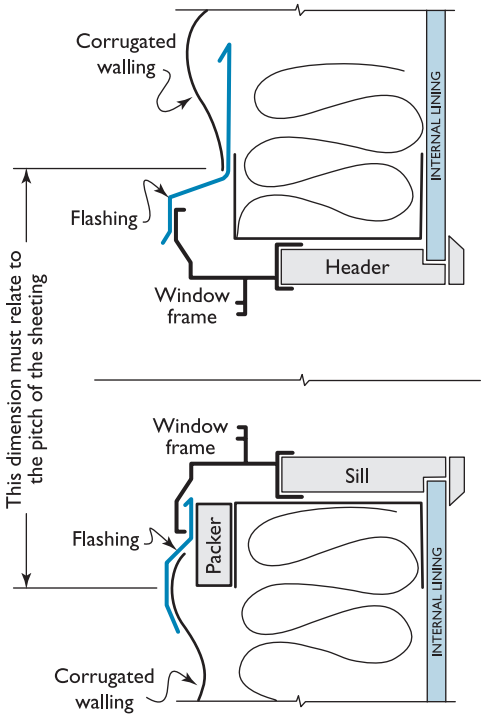
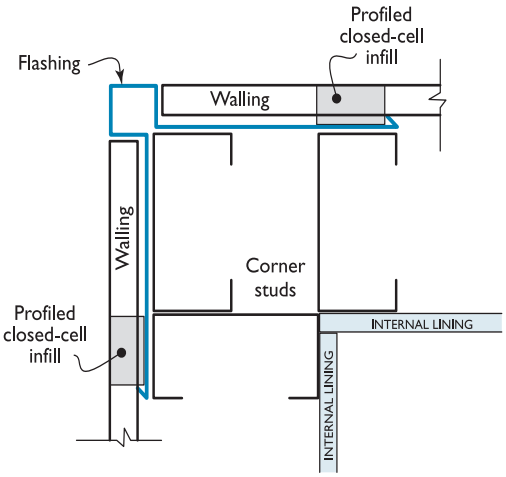
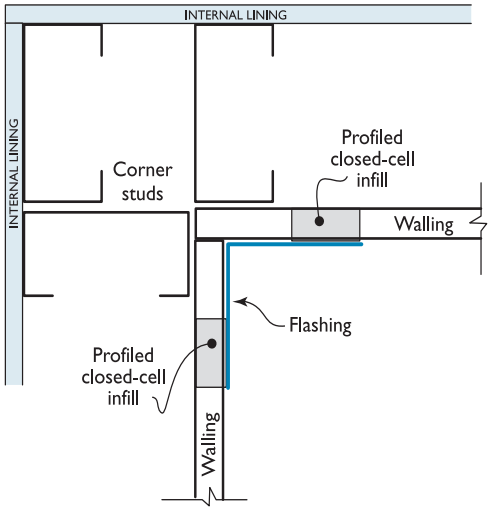


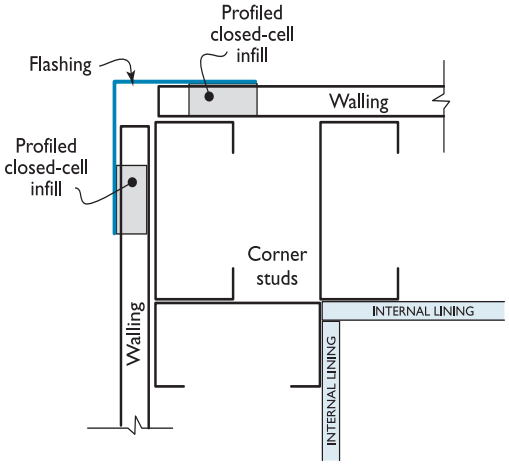
Figure 11.7.1
Typical header and sill flashing: profile running horizontally (elevation)



Typical external corner flashing type 1: profile running horizontally (plan)

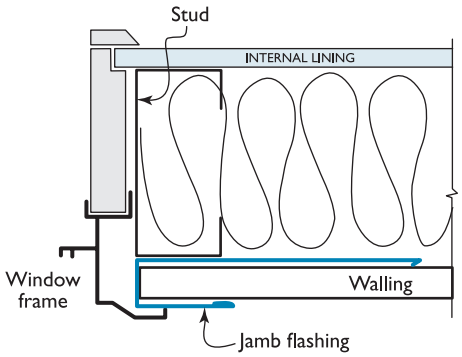


Typical re-entrant corner flashing: profile running horizontally (plan)

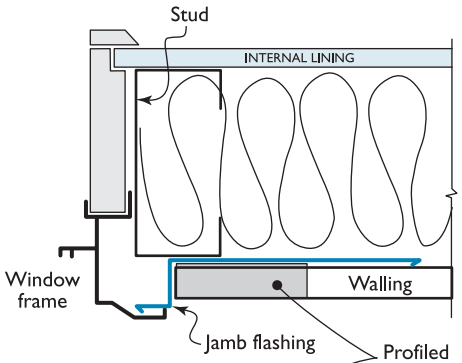


Typical external corner flashing type 2: profile running horizontally (plan)

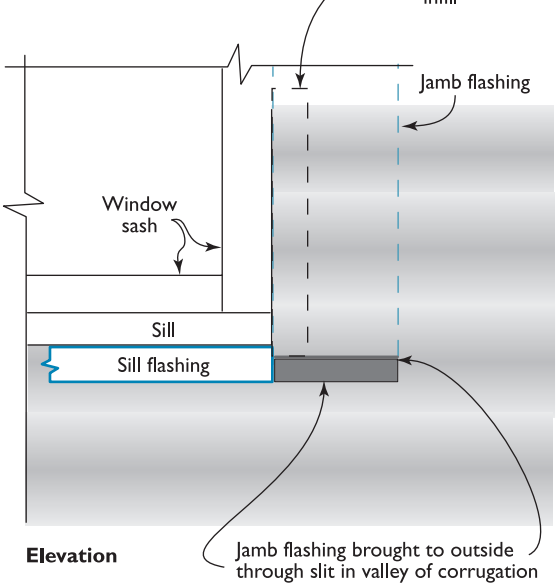
Figure 11.7.2
Typical corner flashings: profile running horizontally (plan view)



Plan view option 1



Plan view option 2



Elevation

Figure 11.7.3
Typical flashing at window and door jambs: profile running horizontally

Walling profile running vertically

Flashings are generally easier on jobs where the profile runs vertically (Figures 11.7.4 and 11.7.5).

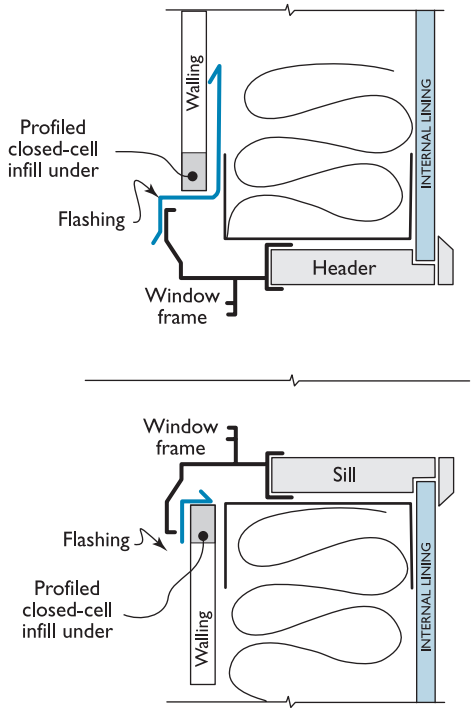


Figure 11.7.4
Typical header and sill flashing: profile running vertically (elevation).

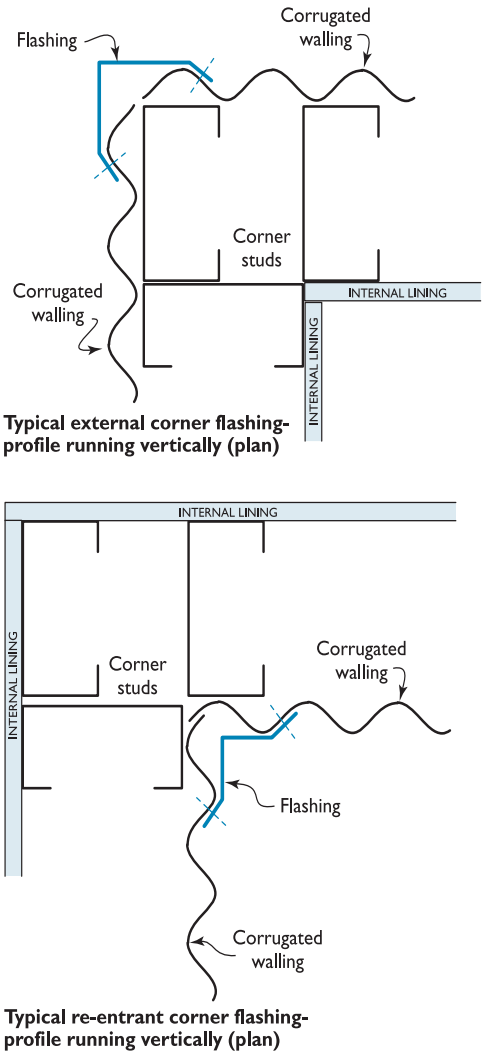


Figure 11.7.5
Typical corner flashings: profile running vertically (plan). Jamb flashings follow same principle.

11.8 Bushfire protection

AS-3959:2009 sets out requirements for the design and construction of buildings in bushfire-prone areas. It calls for flashings to be bedded on fire resistant insulation material. Be sure that flashings fit closely. Transverse flashings should be notched or scribed (Figures 11.3.1 and 11.8.1)

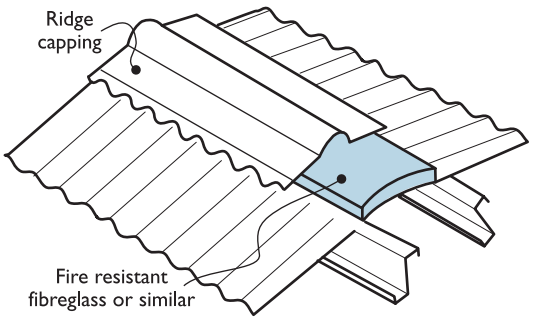


Figure 11.8.1
Typical protection from sparks at ridge

References

Australian Standards

AS/NZS 1170.1:2011 Structural design actions - Permanent, imposed and other actions

AS/NZS 1170.2:2011 Structural design actions - Wind actions

AS/NZS 1170.3:2011 Structural design actions - Snow and ice actions

AS 1170.4:2011 Structural design actions - Earthquake actions in Australia

AS/NZS 1397:2013 Steel sheet and strip—Hot-dipped zinc-coated or aluminium/zinc-coated

AS/NZS 1562.1:1992 Design and installation of sheet roof and wall cladding—Metal

AS/NZS 2179.1:1994 Specification for rainwater goods, accessories and fasteners — Metal shape or sheet rainwater goods, and metal accessories and fasteners

AS/NZS 2334:1980 Steel nails — Metric series

AS/NZS 2728:2007 Prefinished/prepainted sheet metal products for interior/exterior building applications — Performance requirements

AS 3500.3:2003 Plumbing and drainage — Stormwater drainage

AS 3566.1:2002 Self-drilling screws for the building and construction industries - General requirements and mechanical properties

AS 3959:2009 Construction of buildings in bushfire-prone areas

AS 4040.1:1992 Methods of testing sheet roof and wall cladding—Resistance to concentrated loads

AS 4040.2:1992 Resistance to wind pressures for non-cyclone regions

AS 4055:2006 Wind loads for housing

AS/NZS 4256.1:2006 Plastic roof and wall cladding materials

HB39:1997 Installation code for metal roof and wall cladding

HB63:1994 Home insulation in Australia

HB106:1998 Guidelines for the design of structures in snow areas

BlueScope

Amongst the publications of BlueScope, the following are particularly appropriate.

Technical bulletins (General)

TB-1 Steel roofing and walling products: Selection guide

TB-2 Overpainting and restoration of COLORBOND® prepainted steel sheet

TB-4 Maintenance of COLORBOND® prepainted steel roofing

TB-5 Swarf staining of steel roofing and walling profiles

TB-7 Care and Storage of BlueScope Steel coated steel products prior to installation

TB-8 Flashing materials for ZINCALUME® & COLORBOND® steel sheet

TB-13 General guide to good practice in the use of steel roofing and walling products

TB-15 Recommended steel gutter systems

TB-16 Fasteners for roofing and walling product: Selection guide

TB-17 Selection guide for galvanised steel purlin products

Technical bulletins (Corrosion)

CTB-1 General introduction

CTB-8 Building applications

CTB-10 Roof penetrations

CTB-11 Condensation

CTB-12 Dissimilar metals

CTB-13 Contact with timber

CTB-15 Acid cleaning brickwork

CTB-16 Immersion

CTB-17 Following trades

CTB-18 Painting lead flashing

The full range of TBs and CTBs are available for download from our website: www.steel.com.au/library

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